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U.S. Department of Energy
Idaho Operations Office

Mission Need Statement: Calcine Disposition Project

Major Systems Acquisition Project

January 2007

Idaho Cleanup Project

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Prepared for the
U.S. Department of Energy
DOE Idaho Operations Office

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Approved by

Scott G. Van Camp, Assistant Manager
Facility and Material Disposition

1/31/07
Date

Richard B. Provencher, Deputy Manager
Idaho Cleanup Project

2/1/07
Date

James A. Rispoli, Assistant Secretary for
Environmental Management

Apr 17, 2007
Date

Originator: Jan Hagers
Telephone: 208-526-0758
Organization: ICP Calcine Disposition Project

1/29/07
Date

ABSTRACT

This document identifies the need to establish the Calcine Disposition Project to determine and implement the final disposition of calcine including characterization, retrieval, treatment (if necessary), packaging, loading, onsite interim storage pending shipment to a repository or interim storage facility, and disposition of related facilities. A summary of the need is simply stated as follows:

> *As a result of past spent nuclear fuel reprocessing activities at the Idaho Nuclear Technology Engineering Center (INTEC) on the Idaho National Laboratory (INL) Site, approximately 4400 cubic meters (155,000 cubic feet or 1.2 million gallons) of granular-solid high level waste (HLW) calcine was generated and is stored in six bin sets which overlie the Snake River Plain Aquifer, designated by the Environmental Protection Agency as a Sole Source Aquifer. The Idaho Settlement Agreement requires that the Department of Energy put calcine in a form suitable for shipment from Idaho by a target date of 2035. Interim milestones require a National Environmental Policy Act Record of Decision (ROD) by December 31, 2009, to identify the methods that will be used to dispose of calcine including treatment (if necessary) and submission of a Resource Conservation and Recovery Act Part B permit application for the selected treatment by December 1, 2012. As a result, Environmental Management (EM) has identified a need to establish the Calcine Disposition Project to determine and implement the final disposition of calcine including characterization, retrieval, treatment, if necessary, packaging, loading, onsite interim storage pending shipment to a repository or interim storage facility.*

Initiation of the Calcine Disposition Project is a subproject of the Idaho Cleanup Project with responsibility to manage, store, treat as necessary and dispose of the high-level waste calcine stored at the Idaho Nuclear Technology and Engineering Center. Calcine disposition will extend beyond the endpoint of the Idaho Cleanup Project, which is an element of the Department of Energy (DOE) Office of Environmental Management. Approval of the Calcine Disposition Project Critical Decision-0 is needed by March 31, 2007, to begin the work scope to retrieve, treat (if required), package, and load the calcine for interim storage or disposal at the repository and enable DOE to:

- Meet legal commitments made by DOE in the Settlement Agreement and Site Treatment Plan
- Meet EM objectives for accelerated site cleanup outlined in the *DOE Environmental Management Performance Management Plan for the Accelerated Cleanup of the Idaho National Engineering and Environmental Laboratory*
- Avoid possible fines under RCRA
- Implement the 2005 Idaho HLW and Facilities Disposition EIS ROD
- Avoid impacting anticipated spent nuclear fuel swaps between the SRS and INL necessary to complete the Enriched Uranium Disposition Project as currently planned
- Reduce environmental risks of continued storage of radioactive particulate solid waste over the Snake River Plain Aquifer, as evaluated in the *Idaho High-Level Waste and Facilities Disposition Final Environmental Impact Statement*.

To meet the regulatory commitments and reduce project risk, the viability of reasonable alternatives must be maintained while progressing towards a final disposition decision for calcine. Two RODs during project definition are proposed to down-select from a range of reasonable alternatives to a final disposition options. The first, a "dual path" ROD will be issued to meet the Settlement Agreement milestone for selecting a calcine treatment, (based on the October 2002 *Idaho High-Level Waste and Facilities Disposition Final Environmental Impact Statement)*. The dual path ROD will specify the actions necessary to dispose of untreated, canisterized calcine without further treatment, and also describe the actions necessary to dispose of calcine treated by a specific process in the event that regulatory issues associated with untreated calcine (direct disposal) cannot be mitigated. In addition, the dual path ROD will define the decision-making criteria for choosing one disposition path and submitting a RCRA Part B permit application for retrieval and treatment by 2012. Supplement analyses will build on existing evaluations, evaluate regulatory strategies and demonstrate feasibility, including the safety of disposing untreated calcine at the repository. Vitrification is the currently accepted option for disposal of high level waste in the repository and considered the bounding option based on cost and schedule.

The second ROD, an amended ROD choosing one disposition path (either untreated calcine or a specific calcine treatment) and addressing closure of the bin sets and their associated facilities will be issued concurrently with CD-2. Following that amended ROD, DOE would continue to manage the high level waste calcine so it is ready to be moved out of Idaho for disposal by a target date of 2035, in accordance with the 1995 Settlement Agreement. Additionally, it is DOE's goal to complete calcine retrieval, additional treatment (if required), packaging, loading, onsite interim storage, or shipping to a repository (or interim storage) by December 2035, as described in DOE's *Environmental Management Performance Management Plan for Accelerating Cleanup at INEEL*.

Schedules and milestones discussed in this Mission Need Statement are not in all cases consistent with the current Idaho Cleanup Project contract due to changing circumstances. DOE will refine schedules and milestones as required by DOE Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets*, prior to subsequent critical decisions to effectively manage this evolving project and integrate with other DOE projects, programs, and RODs. Existing contracts will be changed as needed to enable completion of the project.

EXECUTIVE SUMMARY

The Calcine Disposition Project is a subproject of the Idaho Cleanup Project (ICP) with responsibility to manage, store, treat as necessary and dispose of the high-level waste calcine stored at the Idaho Nuclear Technology and Engineering Center. The Idaho Cleanup Project is an element of the Department of Energy (DOE) Office of Environmental Management. The Idaho Settlement Agreement[1] requires that DOE put calcine in a form suitable for shipment from Idaho by a target date of 2035. Interim milestones require a National Environmental Policy Act (NEPA) Record of Decision (ROD) to identify the methods that will be used to dispose of calcine including treatment (if necessary) by December 31, 2009, and submission of a Resource Conservation and Recovery Act (RCRA) Part B permit application for the selected treatment by December 1, 2012 (see Table E-1). The consequence of missing a Settlement Agreement milestone is the suspension of DOE spent fuel shipments into Idaho. This Mission Need Statement identifies the need to establish the Calcine Disposition Project to determine and implement the final disposition of calcine including characterization, retrieval, treatment, if necessary, packaging, loading, interim storage or shipment to a repository.

Table E-1. List of current calcine disposition regulatory driven milestones.

Milestone Drivers	Milestone Description	Milestone Date
Settlement Agreement (SA) Section E.6	Issue a Record of Decision (ROD) identifying calcine retrieval and treatment technologies	12/31/2009
	Issue a ROD that includes the schedule for ROD implementation.	12/31/2009
	Submit to the State of Idaho an application for a RCRA (or statutory equivalent) Part B permit	12/1/2012
	The ROD plan and schedule shall provide for the completion of the treatment of all calcined waste located at the INL Site by a target date of 12/31/2035.	12/31/2035
Site Treatment Plan (STP)	Define Calcine Disposition Project (CDP) – Critical Decision – 0 (CD-0)	3/31/2007
	Identify CDP Funding Requirements – CD-1	3/31/2008
	STP Milestone P-2 - Identify and Develop Technology – According to the Settlement Agreement Section E.6, the Record of Decision issued by December 31, 2009 will identify calcine retrieval and treatment technologies. DOE will submit a separate P-2 milestone letter, after ROD signature.	3/31/2010
	Submit CDP Treatability Study Notification	Milestone Not Yet Scheduled
	Submit CDP R&D Permit Applications	Milestone Not Yet Scheduled
	STP Milestone P-5 - Schedule for Table 5-1 (Table 2-1 Milestones/Planning dates) – According to the Settlement Agreement Section E.6, the December 31, 2009, ROD will include the schedule for ROD implementation. DOE will submit a separate P-5 milestone letter after any issues resulting from completion of the P-2 milestone are resolved.	6/30/2010
	Submit RCRA Part B application (or regulatory equivalent) for calcine retrieval, treatment (if necessary) packaging and loading.	12/1/2012

Liquid HLW generated at INTEC on the Idaho National Laboratory (INL) Site was treated by a high-temperature fluidized bed process and converted to a dry, granular solid waste form called calcine. Approximately 4,400 cubic meters of HLW calcine is stored in six bins sets at the Calcined Solids Storage Facility (CSSF). The baseline premise for calcine disposition is retrieval and untreated, direct packaging and loading of calcine for onsite interim storage or disposal at a repository. The Calcine Disposition Project will design calcine retrieval, canister packaging and cask loading systems, interim storage, and initiate RCRA permitting activities. Retrieval, packaging and loading systems, and interim storage are required regardless of the treatment process, if any. Starting retrieval, packaging, and loading design early allows integration with the Integrated Waste Treatment Unit (IWTU) design for treatment of sodium bearing waste. Integration between the Calcine Disposition Project and the Sodium Bearing Waste Project is expected to result in cost savings.

The Calcine Disposition Project will use the NEPA process for project decision making. The repository license application has been delayed and that delay contributes to disposal uncertainty. To meet the 2009 Settlement Agreement milestone, a dual path ROD based on DOE's *Idaho High-Level Waste and Facilities Disposition Final Environmental Impact Statement* – specifying the actions necessary to dispose of untreated, canisterized calcine or the actions to demonstrate, design, permit, build and operate a treatment and canisterization facility – will be developed in parallel with the retrieval, packaging, loading, and onsite interim storage design. The dual path ROD will also define the decision-making criteria for choosing one disposition path by 2012. Supplement analyses will build on existing NEPA evaluations that assess alternate treatments, evaluate regulatory strategies and demonstrate the safety of disposing untreated calcine at the repository. This approach leverages past work, maintains project flexibility despite repository licensing uncertainty and meets DOE's Settlement Agreement commitments. Two alternatives will be identified in the dual path ROD, currently anticipated to be:

- Calcine direct disposal – This alternative would involve retrieval of calcine from the bin sets and preparation, packaging, loading, and interim storage or just-in-time shipment to the repository.

- Calcine treatment and disposal – This alternative would build on previous evaluations of various calcine treatments and entail retrieval of calcine from the bin sets, treating it to a suitable form, packaging, loading, and interim storage or just-in-time shipment to the repository. Three options in addition to direct disposal have been selected for further evaluation – direct vitrification, hot isostatic pressing, and steam reforming. One preferred treatment option will be selected in the dual path ROD. Vitrification is the currently accepted treatment for disposal of high level waste in the repository and considered the bounding option based on cost and schedule.

An amended ROD choosing one disposition path (either untreated calcine or a specific calcine treatment) and addressing closure of the bin sets and their associated facilities will be issued and a RCRA Part B permit application will be submitted in 2012. Following issuance of the amended ROD, DOE will manage the high level waste calcine so it is ready to be moved out of Idaho for disposal by a target date of 2035, in accordance with the 1995 Settlement Agreement. Interim storage is included in the baseline to store calcine in a "road ready" form in case it is not a high priority on the repository receipt schedule and cannot be shipped from Idaho by 2035. It is DOE's goal to complete calcine retrieval, additional treatment (if required), packaging, loading, interim storage or shipping to the repository by December 2035.

If the Calcine Disposition Project is not initiated and the waste subsequently retrieved, treated (if required), packaged, loaded, and readied for onsite interim storage or shipment out of Idaho, potential consequences include the following:

- DOE spent nuclear fuel (SNF) shipments into Idaho will be suspended. (The Settlement Agreement states in Section K.1.a. "If DOE fails to satisfy the substantive obligations or requirements it has agreed to in this Agreement or fails to meet deadlines for satisfying such substantive obligations or requirements, shipments of DOE spent fuel to INEL shall be suspended unless and until the parties agree or the Court determines that such substantive obligations or requirements have been satisfied.") Suspension of fuel shipments into Idaho could impact the anticipated spent nuclear fuel swaps planned between the Savannah River Site (SRS) and Idaho National Laboratory between FY 2008 and FY 2016, as addressed in the Enriched Uranium Disposition Project. Critical Decisions (CD-0 and CD-1) were approved for the Enriched Uranium Disposition Project in 2006.

- DOE's ability to optimize cost efficiencies may be compromised if regulatory issues associated with untreated calcine are not pursued in the near term. The largest project risk for calcine disposition is the ability to demonstrate compliance with the repository waste acceptance criteria, since the waste acceptance criteria are not established. The repository license application has been delayed, increasing this risk because of the resultant delay in review and approval of regulatory initiatives. If the direct disposal option is lost, calcine disposition will likely default to vitrification with the following financial impacts (when vitrification is compared to direct disposal; comparison costs for other treatments would fall between the listed extremes):

  - Increased life-cycle costs for facility design, construction, operation, shipping and decontamination and decommissioning of $17.0 billion versus $2.7 billion (includes 50% contingency for vitrification and 40% contingency for direct disposal, based on costs in the *Independent Calcine Disposition Project Review and Cost Estimate*, performed under Contract DE-AT07-06ID60550 by C/P/E Environmental Services, LLC [2]).

  - Increased repository charges of up to $2.8 billion for disposal. The INL will generate up to 4,500 more HLW borosilicate glass canisters for disposal at the repository and, under current methods of calculation, would use up to approximately 2,500 metric-tons heavy metal (MTHM) more of the repository's capacity that could otherwise be used for additional spent nuclear fuel disposal.

- Idaho Department of Environmental Quality (DEQ) may not renew the RCRA permit for HLW calcine storage in the CSSF (which will be issued for a period of ten years and includes an exemption for secondary containment) and could demand initiation of RCRA closure activities. Failure to meet the closure schedule, even if caused by non-availability of the repository, could result in fines. Ultimately, the closure schedule could be enforced by consent order. Fines could total $10,000/day for each tank. There are 43 bins (tanks) storing calcine in the CSSF. Therefore, the maximum fine could reach $430,000/day until calcine is removed from the storage and the CSSF closed according to RCRA requirements.

- Health and environmental risks, evaluated in the *Idaho High-Level Waste and Facilities Disposition Final Environmental Impact Statement*[3] of continued storage of radioactive particulate solid high-level waste over the Snake River Plain Aquifer will continue. The Final EIS showed that, although unlikely, the estimated probability of the maximum reasonably foreseeable accident for the No Action and Continued Current Operations Alternatives is a factor of nine times more likely than the comparable accidents for the other waste treatment alternatives evaluated that place waste in a road-ready form over a 35-year period. (December 2005 ROD[4] for the *Idaho High-Level*

Waste and Facilities Disposition Final Environmental Impact Statement – DOE/EIS-0287, page 10)

- Stakeholders, including state and federal administrative bodies, will lose confidence in DOE's ability to meet legally binding commitments.

Initiation of the Calcine Disposition Project through the approval of CD-0 mitigates the consequences listed above and enables DOE to meet its legal obligations despite uncertainty surrounding the repository licensing process. It leverages design and construction activities for treatment of sodium-bearing waste by integrating the common facility features. It allows for continued SNF shipments into Idaho, which supports the anticipated SRS and INL planned SNF swaps. Finally, it enables DOE's goals of accelerating cleanup, reducing environmental risk and reducing clean-up costs.

Schedules and milestones discussed in this Mission Need Statement are not in all cases consistent with the current Idaho Cleanup Project contract due to changing circumstances. DOE may refine schedules and milestones as required by DOE Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets*,[5] prior to subsequent critical decisions to effectively manage this evolving project and integrate with other DOE projects, programs, and RODs. This may result in negotiating contract changes.

CONTENTS

FIGURES

TABLES

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ACRONYMS

AEAT	AEA Technology
ALARA	as low as reasonably achievable
CD	Critical Decision
CDP	Calcine Disposition Project
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CSO	Cognizant Secretarial Office
CSSF	Calcined Solids Storage Facility
D&D	decontamination and decommissioning
DEQ	(Idaho) Department of Environmental Quality
DOE	U.S. Department of Energy
DOE-EM	U.S. Department of Energy – Environmental Management
DOE-ID	U.S. Department of Energy – Idaho Operations Office
EIS	environmental impact statement
EM	Environmental Management
EPA	U.S. Environmental Protection Agency
FEIS	final environmental impact statement
FFCA	Federal Facility Compliance Act
HIP	hot isostatic pressing
HLW	high-level waste
HLW&FD EIS	High-Level Waste and Facility Disposition Environmental Impact Statement
HWMA	Hazardous Waste Management Act
ICP	Idaho Cleanup Project
INEEL	Idaho National Engineering and Environmental Laboratory
INL	Idaho National Laboratory

INTEC	Idaho Nuclear Technology and Engineering Center
ISMS	Integrated Safety Management System
IWTU	Integrated Waste Treatment Unit
LLC	limited liability corporation
MNS	Mission Need Statement
MTHM	metric ton heavy metal
NEPA	National Environmental Policy Act
NNSA/NV	U.S. Department of Energy – National Nuclear Security Administration, Nevada Operations Office
NRC	U.S. Nuclear Regulatory Commission
NWCF	New Waste Calcining Facility
OCRWM	Office of Civilian Radioactive Waste Management
OECM	DOE Office of Engineering and Construction Management
OSHA	Occupational Safety and Health Act
PDSA	preliminary documented safety analysis
PMP	Performance Management Plan
RCRA	Resource Conservation and Recovery Act
ROD	record of decision
SA	Settlement Agreement
SAR	safety analysis report
SBW	sodium-bearing waste
SNF	spent nuclear fuel
SRS	Savannah River Site
STD	standard
STP	site treatment plan
TFF	Tank Farm Facility
TRU	transuranic waste

TSPA	Total Systems Performance Assessment (model)
USC	U.S. Code
USDC	U.S. District Court
VE	Value Engineering
VPP	Voluntary Protection Program
WAC	waste acceptance criteria
WASRD	Waste Acceptance System Requirements Document
WBS	work breakdown structure
WCF	Waste Calcining Facility
WIPP	Waste Isolation Pilot Plant

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Mission Need Statement:
Calcine Disposition Project

Major Systems Acquisition Project

1. STATEMENT OF MISSION NEED

The mission of the Calcine Disposition Project is to manage, store, treat (if required), and dispose of 4,400 cubic meters of U.S. Department of Energy (DOE) high-level waste (HLW) calcine stored in stainless steel bins on the Idaho National Laboratory Site. Calcine is the second largest source of radioactivity at the INL Site (stored spent nuclear fuel is the largest source). The Calcine Disposition Project mission supports the Department of Energy's 2003 Strategic Plan Environmental Strategic Goal, "To protect the environment by providing a responsible resolution to the environmental legacy of the Cold War and by providing for the permanent disposal of the Nation's high-level radioactive waste." Disposition of calcine at a repository will result in significant reduction in risk to the environment by removing HLW storage over the Snake River Plain Aquifer.

Calcine is regulated under the Resource Conservation and Recovery Act (RCRA) and the Nuclear Waste Policy Act. The final disposition of calcine will be in a repository. DOE has a legal obligation, established by the 1995 Idaho Settlement Agreement, to have calcine in a condition to allow shipment to and disposal in a repository by a target date of December 31, 2035. The Idaho Settlement Agreement also established interim milestones for calcine including a requirement that a National Environmental Policy Act (NEPA) Record of Decision (ROD), establishing the planned schedule for analyzing the treatment alternatives for of calcine, be issued no later then December 31, 2009. DOE issued the *Idaho High-Level Waste and Facilities Disposition Final Environmental Impact Statement* in 2002, and will issue a ROD(s) based on this EIS to comply with the Settlement Agreement. Meeting the Settlement Agreement milestones will require implementation of all eight strategies developed for Goal 6, Environmental Management, of the 2003 Strategic Plan.

The capabilities to retrieve, package, and load HLW calcine into casks for interim storage or disposal are not currently available at the INL Site. DOE will issue a dual path ROD in 2009, and an amended ROD choosing a single disposal path concurrently with issuance of CD-2. The Calcine Disposition Project will implement the amended ROD through development of technology, construction of necessary facilities, retrieval, treatment (if required) packaging, loading, interim storage and/or disposal in the repository.

The 4,400 cubic meters (155,000 cubic feet, or about 1.15 million gallons) of high-level waste calcine is stored in bins at the INTEC Calcined Solids Storage Facility (CSSF). Idaho Nuclear Technology and Engineering Center (INTEC) is located at the Idaho National Laboratory Site, which is a DOE facility located west of Idaho Falls, Idaho, in the northeastern portion of the Eastern Idaho Snake River Plain. The calcine is located over the Snake River Plain Aquifer, which is the major source of drinking water for southeastern Idaho and designated by the U.S. Environmental Protection Agency (EPA) as a Sole Source Aquifer. A RCRA Part B permit application was submitted for storage of calcine in 2004.

The 1995 Idaho Settlement Agreement states, "DOE shall accelerate efforts to evaluate alternatives for the treatment of calcined waste so as to put it into a form suitable for transport to a permanent repository or interim storage facility outside Idaho. It is presently contemplated by DOE that the plan and schedule shall provide for the completion of the treatment of all calcined waste located at the INEL Site

by a target date of December 31, 2035." DOE originally planned to store treated calcine from 2035 until it was shipped to a repository by 2070.[6] Two interim milestones in the Settlement Agreement determine the critical path for calcine disposition in the next seven years. A ROD to specify a calcine treatment is required by December 31, 2009, and a RCRA Part B permit application submittal to the State of Idaho is required by December 1, 2012.

Work to date indicates that calcine can be safely disposed at the repository without further treatment, with the approval of a petition by EPA to remove calcine from RCRA regulation. However, the largest project risk for calcine disposition is the ability to demonstrate compliance with the repository detailed waste acceptance criteria. The repository license application has been delayed, which increases this risk because of the resultant delay in review and approval of regulatory initiatives.

To meet the requirement to issue a ROD while maintaining the viability of untreated disposal, a "dual path" ROD will be issued to meet the Settlement Agreement milestone for selecting a calcine treatment, (based on the October 2002 *Idaho High-Level Waste and Facilities Disposition Final Environmental Impact Statement)*. The dual path ROD will specify the actions necessary to dispose of untreated, canisterized calcine without further treatment, and also describe the actions necessary to dispose of calcine treated by a specific process in the event that regulatory issues associated with untreated calcine (direct disposal) cannot be mitigated. In addition, the dual path ROD will define the decision-making criteria for choosing one disposition path and submitting a RCRA Part B permit application in 2012. Supplement analyses will build on existing evaluations that assess three treatment options, evaluate regulatory strategies and demonstrate the feasibility and safety of disposing untreated calcine at the repository. The dual path ROD is scheduled to be issued in 2009 to meet the Settlement Agreement milestone. Figure 1 pictorially depicts the dual-path approach. Two alternatives will be identified in the dual path ROD, currently anticipated to be:

- Calcine direct disposal – This alternative would involve retrieval of calcine from the bin sets and preparation, packaging, loading, and interim storage or just-in-time shipment to the repository.

- Calcine treatment and disposal – This alternative would build on previous evaluations of various calcine treatments and entail retrieval of calcine from the bin sets, treating it to a suitable form, packaging, loading, and interim storage or just-in-time shipment to the repository. Three options in addition to direct disposal have been selected for further evaluation – vitrification, hot isostatic pressing, and steam reforming. One preferred treatment option will be selected in the dual path ROD. Vitrification is the currently accepted option for disposal of high level waste in the repository and considered the bounding option based on cost and schedule.

An amended ROD choosing one disposition path (either untreated calcine or a specific calcine treatment) and addressing closure of the bin sets and their associated facilities will be issued and a RCRA Part B permit application will be submitted in 2012. Following issuance of the amended ROD, DOE will manage the high level waste calcine so it is ready to be moved out of Idaho for disposal by a target date of 2035, in accordance with the 1995 Settlement Agreement. Interim storage is included in the baseline to store calcine in a "road ready" form in case it is not a high priority on the repository receipt schedule and cannot be shipped from Idaho by 2035. It is DOE's goal to complete calcine retrieval, additional treatment (if required), packaging, loading, interim storage or shipping to the repository by December 2035, as described in DOE's *Environmental Management Performance Management Plan for Accelerating Cleanup at Idaho National Engineering and Environmental Laboratory*.[7]

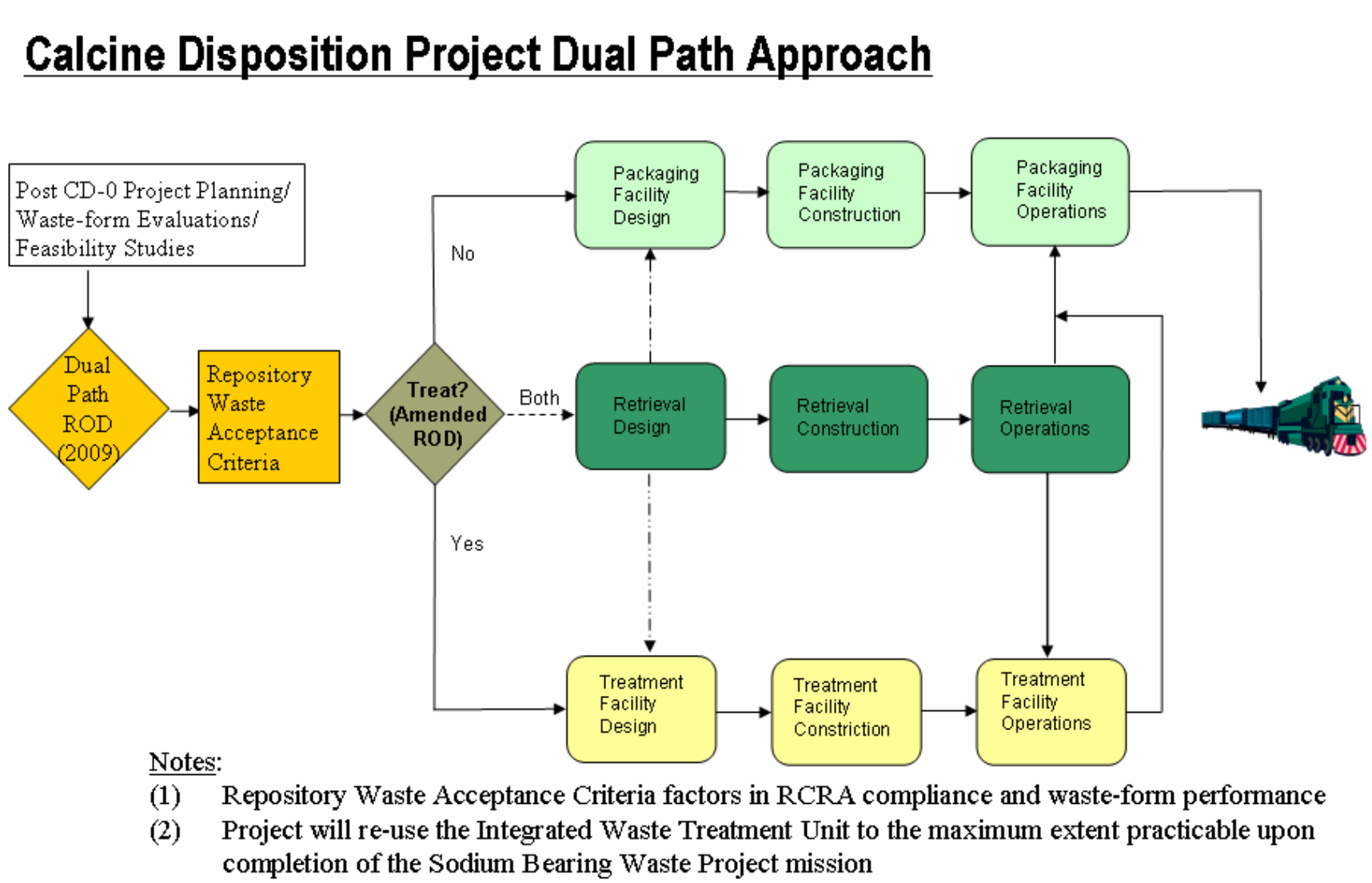

Figure 1. Representation of Calcine Disposition Dual Path ROD.

In the event that the treatment decision is delayed, the Settlement Agreement/Consent Order provides that DOE may request a modification to conform to the selected actions if the actions conflict with the Agreement. A strategy document outlining criteria for regulatory and technology decisions will be prepared early in the project schedule. Maintaining DOE's options for choosing the best disposition path necessitate project initiation and near term action on the project.

1.1 Background

From 1952 to 1992, DOE and its predecessor agencies reprocessed spent nuclear reactor fuel at the Idaho Chemical Processing Plant, located on the Snake River Plain in southeast Idaho. This facility, now known as the INTEC, is part of the INL Site. Processing operations at INTEC utilized multiple cycles of solvent extraction to recover uranium-235 and other defense-related materials from spent nuclear reactor fuel. These reprocessing activities, as well as other ancillary facility activities and operations, generated millions of gallons of liquid-radioactive wastes, which were stored in the INTEC Tank Farm Facility (TFF) in eleven large (300,000-gal) underground storage tanks. These tank wastes are regulated as a mixed radioactive waste under RCRA due to their hazardous constituents.

A high-temperature fluidized bed calcination process was put in operation in the early 1960s to convert the liquid tank waste into small, granular solids called calcine. The calcination process produced a safer product for storage while reducing the volume of stored waste by an average factor of seven. Approximately eight million gallons (30,300 m^3) of tank waste were converted to approximately 4,400 m^3 calcine and pneumatically transferred to the CSSF at INTEC where it is currently stored awaiting future disposition.

Calcine production began in November 1963 with the use of the Waste Calcining Facility (WCF). Calcine produced by the WCF filled CSSF I through CSSF III. The New Waste Calcining Facility (NWCF) produced calcine from September 1982 through May 2000. NWCF calcine went into CSSF IV, CSSF V, and CSSF VI. Calcine production was suspended and the calcination process placed in standby in May 2000 (since closed in 2004 under RCRA) in compliance with a State of Idaho-issued Consent Order because of environmental and air quality regulations and issues with the NWCF. (The calcination process was in compliance with RCRA Interim Status requirements during its operation.)

Approximately 4,400 m^3 (155,000 ft^3, or about 1.15 million gallons) of granular-solid HLW calcine is stored in the CSSF at INTEC. The CSSF is made up of seven sets of bins, although the seventh bin set has not been used. The bin sets are of varying designs, containing from 3 to 12 stainless-steel bins per bin set. Each bin set is housed in its own concrete vault. The bins range from about 6.1 to 20.8 m (20 to 68 ft) in height. The generation dates of the calcine range from 1963 for the oldest calcine in CSSF I to 2000 for some of the calcine in the CSSF VI. Six of the bin sets store calcine, while the seventh bin set remains empty and uncontaminated.

HLW calcine is hazardous waste because it exhibits hazardous characteristics of toxicity for metals (hazardous waste numbers D004 through D011) and contains listed hazardous wastes, specifically spent solvents (hazardous waste numbers F001, F002 and F005), and discarded hydrogen fluoride (hazardous waste number U134). The hazardous waste numbers identified for HLW are listed in Table 1.

Table 1. List of hazardous waste numbers for the INL Site's high-level radioactive waste.

Hazardous Waste Numbers	Description
D004	Arsenic
D005	Barium
D006	Cadmium
D007	Chromium
D008	Lead
D009	Mercury
D010	Selenium
D011	Silver
F001	1,1,1-Trichloroethane Trichloroethylene Carbon Tetrachloride
F002	1,1,1-Trichloroethane Trichloroethylene Carbon Tetrachloride Tetrachloroethylene
F005	Benzene Carbon Disulfide Pyridine Toluene
U134	Hydrogen Fluoride (hydrofluoric acid)

Sources:

"Regulatory Analysis and Reassessment of U.S. Environmental Protection Agency Listed Hazardous Waste Numbers for Applicability to the INTEC Liquid Waste System," Revision 1, (INEEL/EXT-98-01213) Idaho National Engineering and Environmental Laboratory, February 1999.

"NWCF Calcine Emissions Inventory – Final Report for Phase IV Testing," (INEEL/EXT-01-00260) Idaho National Engineering and Environmental Laboratory, February 2001.

"HWMA/RCRA Part A Permit Application for the INEEL Volume I," Bechtel BWXT Idaho, LLC, Rev. 35, December 9, 2002.

HLW is the highly radioactive material resulting from reprocessing spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from the liquid waste that contains fission products in sufficient concentrations, and other highly radioactive material that is determined, consistent with existing law, to require permanent isolation. HLW stored at INTEC contains a combination of:

- Highly radioactive, but relatively short-lived (approximately 30-year half-life) fission products (primarily Cs-137 and Sr-90)
- Long-lived radionuclides — Tc-99, C-14, and I-129 as well as transuranics (elements with atomic numbers greater than uranium).

The activity of calcine depends on the age of the waste and the type of calcine. The calcine has aged enough that there is no detectable activity of short-lived fission products. The principle radionuclides in the calcine include Sr-90 (and its short-lived daughter Y-90), Cs-137 (and its short-lived daughter Ba-137m), Pu-238, and Pu-239. Table 2 shows typical activity levels for the four types of calcine. The exposure rates associated with the calcine routinely exceed 10 roentgen equivalent man per hour (rem/hr) on a 15-milliliter (mL) sample. General body fields in the CSSF I vault are currently estimated to exceed 6,000 rem/hr. Radiation fields of this magnitude pose a potentially serious hazard to workers at the INL Site, if appropriate protective measures such as time, distance, and shielding are not applied.

Table 2. Typical radionuclide activity in INTEC calcine (picocuries per gram [pCi/g]).

Radionuclide	Alumina	Alumina-Na Blend	Zirconia	Zirconia-Na Blend
Sr-90	3×10^9	3×10^8	2×10^9	2×10^9
Cs-137	3×1^9	3×10^8	2×10^9	2×10^9
Pu-238	1.5×10^6	3×10^6	2.5×10^7	2.5×10^7
Pu-239	2×10^5	1.5×10^5	2×10^5	7×10^5

1.2 Regulatory Drivers for the Calcine Disposition Project

Calcine is a HLW because it is first cycle raffinate from the reprocessing of spent nuclear fuel. It is HLW by source, as defined by the Nuclear Waste Policy Act and DOE Order 435.1, *Radioactive Waste Management*. As such, its final disposition is specified in the Nuclear Waste Policy Act as a deep geologic repository. It is also a hazardous waste as defined by RCRA and must be stored and disposed in accordance with 40 CFR Part 261, "Identification and Listing of Hazardous Wastes." Calcine is currently stored and managed according to a RCRA Part B storage permit issued by the Idaho Department of Environmental Quality (DEQ) in November 2006. An exemption for secondary containment was included in the permit, which is for storage for a 10-year period. Storage permits are typically renewed at five-year periods, after the initial ten-year term of the permit. Renewal is granted at the discretion of DEQ or a closure plan and schedule for closure is required within 90 days of the permit's expiration. Under the PMP schedule calcine storage would be needed until 2035. Any final disposition date is predicated on inclusion of a calcine waste form in the repository's Nuclear Regulatory Commission (NRC) license and priority for receipt of calcine in the repository.

The Settlement Agreement specifies that the calcine be treated to a form suitable for transport to the repository by a target date of December 31, 2035. Interim milestones include issuance of a ROD by December 31, 2009, analyzing the treatment options for calcine and specifying the date when calcine treatment will be completed. Also, a RCRA Part B permit application for treatment of calcine (or statutory equivalent, i.e., "as-is" retrieval) shall be submitted by December 1, 2012.

HLW calcine is also managed under the Site Treatment Plan (STP), a joint DOE/Idaho plan for developing treatment capacity and technologies for stored mixed waste. The STP was developed pursuant to Section 3021(b) of RCRA, 42 USC 6939c (b), as amended by Section 105(b) of the Federal Facility Compliance Act (FFCA), Pub. L. 102-386 (1992) and the Idaho Hazardous Waste Management Act (HWMA). As required by the STP, DOE submitted a schedule for development of treatment processes and the construction and operation of those processes by September 30, 2005. The Idaho DEQ accepted that schedule and dates were set for completion of CD-0 by December 31, 2006, and CD-1 by

March 31, 2008. The State of Idaho recently approved the DOE Idaho Operations Office (DOE-ID) request that the CD-0 date be changed to March 31, 2007. Other enforceable milestones in the STP for RCRA permitting and issuance of a ROD are consistent with the Settlement Agreement dates.

1.3 Consequences of Not Performing This Action

If the HLW calcine is not retrieved, treated (if required), packaged, loaded, and readied for onsite interim storage or shipment out of Idaho on the schedule presented in this Mission Need Statement (MNS), consequences include the following:

- DOE SNF shipments into Idaho may be suspended. (The Settlement Agreement states in Section K.1.a. "If DOE fails to satisfy the substantive obligations or requirements it has agreed to in this Agreement or fails to meet deadlines for satisfying such substantive obligations or requirements, shipments of DOE spent fuel to INEL shall be suspended unless and until the parties agree or the Court determines that such substantive obligations or requirements have been satisfied.") Suspension of fuel shipments into Idaho could impact the anticipated spent nuclear fuel (SNF) swaps planned between the Savannah River Site (SRS) and Idaho National Laboratory (INL) between FY 2008 and FY 2016, as addressed in the Enriched Uranium Disposition Project (Critical Decisions-0 and 1 approved in 2006).

- DOE's ability to optimize cost efficiencies through direct disposal of calcine may be compromised if the regulatory issues associated with untreated calcine are not pursued in the near term. The largest project risk for calcine disposition is the ability to demonstrate compliance with the repository waste acceptance criteria, since the waste acceptance criteria are not established. The repository license application has been delayed, which has increased this risk because of the resultant delay in review and approval of regulatory initiatives. If the direct disposal option is forfeited, calcine disposition will likely default to vitrification since that is the only EPA-approved treatment for HLW, resulting in the following financial impacts (when vitrification is compared to direct disposal; comparison costs for other treatments would fall between the listed extremes):

    - Increased life-cycle costs for facility design, construction, operation, shipping and decontamination and decommissioning of $17.0 billion versus $2.7 billion (includes 50% contingency for vitrification and 40% contingency for direct disposal, based on costs in the *Independent Calcine Disposition Project Review and Cost Estimate*, performed under Contract DE-AT07-06ID60550 by C/P/E Environmental Services, LLC).

    - Increased repository charges of up to $3 billion for disposal. The INL will generate up to 5,000 more HLW (borosilicate glass) canisters for disposal at the repository than for direct disposal and, under current methods of calculation, would use up to approximately 2,500 metric-tons heavy metal (MTHM) more of the repository's capacity that could otherwise be used for additional SNF or HLW disposal.

- Idaho RCRA regulation of the CSSF includes enforcement of Site Treatment Plan milestone and RCRA permit requirements. The project schedule required by the STP can be enforced under the terms of the FFCA and RCRA. It is possible that Idaho Department of Environmental Quality (DEQ) will use the CSSF storage permit and STP milestones and planning dates to force progress on calcine disposition through a consent order in accordance with the general schedule in the Settlement Agreement. Idaho DEQ may not renew the RCRA permit for HLW calcine storage in the CSSF (which includes an exemption for secondary containment) and could demand initiation of RCRA closure activities. Failure to meet the closure schedule, even if caused by non-availability of the repository, could result in fines. Ultimately, the closure schedule could be enforced by consent

order. Fines could total $10,000/day for each tank. There are 43 bins (tanks) storing calcine in the CSSF. Therefore, the maximum fine could reach $430,000/day until calcine is removed from the storage and the CSSF closed according to RCRA requirements.

- Health and environmental risks, evaluated in the *Idaho High-Level Waste and Facilities Disposition Final Environmental Impact Statement* of continued storage of radioactive particulate solid high-level waste over the Snake River Plain Aquifer will continue. The Final EIS showed that, although unlikely, the estimated probability of the maximum reasonably foreseeable accident for the No Action and Continued Current Operations Alternatives is a factor of nine times more likely than the comparable accidents for the other waste treatment alternatives evaluated that place waste in a road-ready form over a 35-year period. (December 2005 ROD for *the Idaho High-Level Waste and Facilities Disposition Final Environmental Impact Statement*, page 10 – DOE/EIS-0287).

- Stakeholders, including state and federal administrative bodies, will lose confidence in DOE's ability to meet legally binding commitments.

The consequence for failure to meet any of the Settlement Agreement milestones is the suspension of DOE SNF shipments into Idaho. The ROD must be issued by December 31, 2009, and a RCRA Part B permit application submitted in December 1, 2012, to meet Settlement Agreement milestones. Submission of the permit application requires that preliminary design be completed and incorporated prior to submission of the permit application.

Health and environmental risks in the Environmental Impact Statement (EIS) are unlikely to be discriminators for different treatment options. Risks associated with shipping, which are proportional to the number of shipments, are likely to be small. Preliminary groundwater modeling indicates that the repository is relatively insensitive to the calcine waste form (EDF-4158, "Preliminary Sensitivity Studies for Total System Performance Assessment in Support of INEEL Calcine Direct Disposal," September 2004).[8] It can be disposed untreated and the calculated transport of radioactive and hazardous constituent concentrations remains several orders of magnitude below concentrations of concern in the underlying repository groundwater. Changes in the EPA radiation standard are unlikely to change this finding. Disposal of calcine requires approval of a petition by the U.S. Environmental Projection Agency (EPA) to remove calcine from RCRA regulation, however, obtaining such approval may be more difficult for the direct disposal option since vitrification is the specified technology for HLW. Use of repository capacity will be a result of the selected treatment, since the selected treatment may increase or decrease the total volume of waste. Currently, each HLW canister is assigned one half metric ton heavy metal (MTHM). The use of 10-ft-tall standard canisters is assumed.

Acceleration of calcine disposition has been published in multiple DOE documents, as outlined in the next section. Stakeholders expect accelerated calcine disposition unless provided clear and compelling reasons for a change.

Initiation of the Calcine Disposition Project mitigates the consequences previously listed and enables DOE to meet its legal obligations despite uncertainty surrounding the repository licensing process. It leverages design and construction activities for treatment of sodium-bearing waste by integrating the common facility features. It allows for continued SNF shipments into Idaho, which supports the anticipated SRS and INL planned SNF swaps. Finally, it enables DOE's goals of accelerating cleanup, reducing environmental risk and reducing clean-up costs.

1.4 Support of the EM Mission

In July 2002, DOE, the Idaho Department of Environmental Quality, and the Environmental Protection Agency signed a letter of intent[9] formalizing an agreement to pursue accelerated risk reduction and cleanup at the INL Site. The letter provides the foundation for a collaborative plan for the accelerated cleanup at the INL Site. DOE developed the *Environmental Management Performance Management Plan for Accelerating Cleanup of the Idaho National Engineering and Environmental Laboratory* (PMP) to implement the letter of intent to fulfill the following agreed upon vision:

- By 2012, the INL Site will have achieved significant risk reduction and will have placed materials in safe storage ready for disposal.
- By 2020, the INL Site will have completed all active cleanup work with potential to further accelerate cleanup to 2016.

The PMP describes nine strategic initiatives DOE proposes to eliminate or reduce the environmental risks at the INL Site. The second strategic initiative is to "Accelerate High-Level Waste Calcine Removal from Idaho." The activities included in calcine removal include:

- Complete characterization of calcine to support repository waste form acceptance criteria by 2012
- Complete construction of calcine retrieval, packaging, and loading facility by 2020
- Retrieve, stabilize, package, load for onsite interim storage or ship calcine to a repository by the end of 2035.

The PMP also coordinates and integrates the schedules and funding profiles of the projects and subprojects needed to realize the vision of accelerated cleanup. All foreseeable capital assets and operating expenditures needed to accomplish the vision were used as a basis for developing the cost estimates that are included in that PMP, which was approved by the Assistant Secretary for Environmental Management. In addition, the DOE-ID *Strategy Plan – 2005 and Beyond*[10] includes the following strategy: "Identify innovative approach to retrieve, treat (if necessary), and package calcine and disposition at MGR [monitored retrievable repository, herein referred to as the repository]." (Strategy EM-3.3). Approval of this Mission Need Statement and initiation of Project Definition and Conceptual Design will provide a mechanism to pursue this strategy. Failure to aggressively pursue published goals and strategies will not be well received by stakeholders.

The ICP contract[11] requires the contractor to complete interim milestones related to design, permitting and NEPA support. These near-term activities are common to all reasonable alternatives considered in the dual path ROD, and will thus be completed regardless of disposition decisions documented in the ROD and integrated into subsequent activities on the selected disposition path. The list of current calcine disposition regulatory driven milestones is shown in Table 3.

It should be noted that schedules and milestones discussed in this Mission Need Statement are not in all cases consistent with the current Idaho Cleanup Project contract due to changing circumstances. DOE will refine schedules and milestones as required by DOE Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets*, prior to subsequent critical decisions to effectively manage this evolving project and integrate with other DOE projects, programs, and RODs. Existing contracts will be changed if needed to enable completion of the project as planned.

Table 3. List of current calcine disposition regulatory driven milestones.

Milestone Drivers	Milestone Description	Milestone Date
Settlement Agreement (SA) Section E.6	Issue a Record of Decision (ROD) identifying calcine retrieval and treatment technologies	12/31/2009
	Issue a ROD that includes the schedule for ROD implementation.	12/31/2009
	Submit to the State of Idaho an application for a RCRA (or statutory equivalent) Part B permit	12/1/2012
	The ROD plan and schedule shall provide for the completion of the treatment of all calcined waste located at the INL Site by a target date of 12/31/2035.	12/31/2035
Site Treatment Plan (STP)	Define Calcine Disposition Project (CDP) – Critical Decision – 0 (CD-0)	3/31/07
	Identify CDP Funding Requirements – CD-1	3/31/2008
	STP Milestone P-2 - Identify and Develop Technology – According to the Settlement Agreement Section E.6, the Record of Decision issued by December 31, 2009, will identify calcine retrieval and treatment technologies. DOE will submit a separate P-2 milestone letter, after ROD signature.	3/31/2010
	Submit CDP Treatability Study Notification	Milestones Not Yet Planned
	Submit CDP R&D Permit Applications	Milestones Not Yet Planned
	STP Milestone P-5 - Schedule for Table 5-1 (Table 2-1 Milestones/Planning dates) – According to the Settlement Agreement Section E.6, the December 31, 2009, ROD will include the schedule for ROD implementation. DOE will submit a separate P-5 milestone letter after any issues resulting from completion of the P-2 milestone are resolved.	6/30/2010
	Submit RCRA Part B application (or regulatory equivalent) for calcine retrieval, treatment (if necessary), packaging, and loading.	12/1/2012

1.5 Calcine Disposition Project Path Forward

Two interim milestones in the Settlement Agreement determine the critical path for calcine disposition in the next seven years. A ROD to specify a calcine treatment is required by December 31, 2009, and a RCRA Part B permit application is required by December 1, 2012.

The Settlement Agreement milestone for selecting a calcine treatment will be satisfied by issuing a dual path ROD, which will describe the actions necessary to dispose of containerized calcine without further treatment, and also describe the actions necessary to dispose of calcine treated by a specific process selected as part of the NEPA supplement analysis leading to an amended ROD in December 2011. The ICP contractor must support DOE in completing a NEPA supplement analysis prior to issuing the dual path ROD. Preliminary Design must be completed for treatment and incorporated in the permit application (or regulatory equivalent), prior to its submission, to meet RCRA requirements and to fulfill STP milestones for CD-0 (March 31, 2007) and CD-1 (March 31, 2008).

These requirements and alternative treatment technologies necessitate project initiation and near term action on the project to support the accelerated schedule.

2. ANALYSIS TO SUPPORT MISSION NEED

After termination of reprocessing of spent nuclear fuel in 1992, numerous options for disposition of HLW calcine were evaluated. In 1997, DOE began preparing the *Idaho High Level Waste and Facilities Disposition Final Environmental Impact Statement*. The HLW&FD EIS analyzed alternatives for HLW calcine disposition, including the option of leaving the waste in place, and established their impacts to the environment in accordance with the NEPA process. A final EIS was issued in September 2002.

Under a phased decision making strategy for the HLW&FD EIS, DOE issued the first of several planned RODs in December 2005. In the December 2005 ROD, DOE announced its decision to treat liquid sodium-bearing waste by a process called steam reforming, which would produce a calcine-like waste form that DOE proposes to dispose of at the Waste Isolation Pilot Plant (WIPP) as transuranic (TRU) waste. Until a determination is made that this product is TRU waste, DOE will manage the waste to allow disposal at either WIPP or a repository for HLW. The Calcine Disposition Project scope and cost estimates do not include disposition of SBW calcine.

The final EIS showed the risks of leaving the solid calcine were unacceptable due to the related long-term impacts to the environment (e.g., potential for contamination of the Snake River Plain Aquifer). In addition, such an option would not meet current legal agreements and regulatory requirements as outlined in Section 1 of this Mission Need Statement and is not consistent with DOE-EM goals of accelerated cleanup. Shipping the wastes to another site in the DOE complex for treatment was also evaluated in the EIS. The option evaluated was to send calcine waste to Hanford for vitrification. Logistical difficulties, stakeholder opposition to shipping waste to other than a permanent repository for final disposal, the attendant costs, incompatibility of acidic calcine with the Hanford vitrification process, and conflicting processing schedules limited the viability of the option.

A dual path ROD will be issued for the disposition of calcine, describing the decision criteria and actions necessary to dispose of containerized calcine without further treatment, as well as the actions necessary to dispose of calcine treated by one specific process selected as part of the NEPA process leading to the dual path ROD. The one specific treatment process will be selected from three treatment options. A Value Engineering (VE) session held March 21 and 22, 2006, scored ten calcine treatment options by using GO/NO-GO criteria and reduced the list to three options for further cost analysis. The three treatment options recommended for further evaluated were direct vitrification, hot isostatic pressing, and steam reforming. The basis for the recommendation is that vitrification presents the least risk for acceptance at the repository, hot isostatic pressing graded the highest during the VE session, and steam reforming could utilize portions of the facility and process developed for sodium-bearing waste disposition. Reducing the number of treatment options streamlines the analysis and selection process for the ROD and will reduce the resources required to complete the process.

The RCRA Part B permit application must have sufficient design information to achieve regulatory approval for retrieval, treatment (if required), packaging, loading, and interim storage prior to submittal to Idaho DEQ by December 1, 2012. Vitrification is currently the only EPA-approved treatment for HLW, and any other treatment for HLW calcine requires an equivalency or exemption from EPA. However, vitrification of calcine will require approval of a delisting petition from EPA before it may be disposed at the repository. The EPA petition (or equivalent regulatory initiative) will be submitted after the treatment is selected, the selected waste form testing is completed, and confirmatory Total System Performance Assessment (TSPA) modeling is performed. Based on EPA guidelines and actual timelines from other petitions, EPA approval for disposal of either untreated or treated calcine is expected to take from three to five years. Approval of legislative proposals currently under consideration by Congress such as the *Nuclear Fuel Management and Disposal Act* may exempt from the requirements of RCRA any material

owned by the Secretary of Energy (such as HLW calcine) if it is transported in a package, cask, or other container certified by the NRC for transportation or storage of the material to the repository.

Critical Decision 0 (CD-0), Approval of Mission Need, is being sought at this time to initiate the Calcine Disposition Project and proceed with:

- Regulatory and permitting activities for disposal of untreated or treated calcine
- Performance of calcine retrieval, transport, and handling/packaging/loading tests
- Design activities required by the STP.

In order to support legal and regulatory obligations, considerable work on the project must be performed within the period ending in 2012. Therefore, it is critical that approval of the Calcine Disposition Project CD-0 occur by March 31, 2007, as scheduled in the STP. Following Conceptual Design, the Preliminary Design for retrieval, treatment (if required), packaging, loading, and onsite interim storage must be completed and incorporated in the RCRA Part B permit application before its submittal to Idaho DEQ by the December 1, 2012, Settlement Agreement milestone. CD-1, needed to initiate preliminary design, is required by the STP in March 2008. Final Design and construction will occur after the ICP contract period, succeeded by testing, readiness review, and startup for an operations phase.

3. IMPORTANCE OF MISSION NEED AND IMPACT IF NOT APPROVED

3.1 Importance of Need for the Calcine Disposition Project

Approval of this Mission Need Statement provides the basis for project funding in support of disposition of the HLW calcine. Capabilities do not currently exist at the INL Site for retrieval, packaging, loading, and onsite interim storage, and therefore, must be constructed under a Major System Acquisition Project. Approval of this mission need document will initiate the project to:

- Meet legal commitments made by DOE in the Settlement Agreement
- Meet legal Site Treatment Plan milestone commitments
- Meet EM objectives for accelerated site cleanup outlined in the *DOE Environmental Management Performance Management Plan for the Accelerated Cleanup of the Idaho National Engineering and Environmental Laboratory*
- Reduce environmental risks of continued storage of radioactive particulate solid waste over the Snake River Plain Aquifer
- Assist in gaining stakeholders confidence in DOE's ability to meet legally binding commitments
- Provide the flexibility to directly dispose or treat calcine
- Implement the December 2005 Idaho HLW and Facilities Disposition EIS ROD.

3.2 Impact of Not Executing the Calcine Disposition Project

Failure to approve and execute the Calcine Disposition Project will result in DOE not meeting the legal requirements of the Settlement Agreement and Site Treatment Plan or the DOE accelerated cleanup plan goals for the INL Site. The following consequences will result if calcine is not retrieved, treated (if required), packaged, loaded for onsite interim storage or shipped off-Site for disposal:

- Failure to comply with the Settlement Agreement between DOE, the Department of the Navy, and the State of Idaho, which could result in the suspension of DOE spent fuel shipments to the INL Site. Suspension of fuel shipments into Idaho could impact the anticipated spent nuclear fuel swaps planned between the SRS and INL, as addressed in the approved Enriched Uranium Disposition Project CD-0 and CD-1.

- Failure to reduce long-term risks to human health and the environment, as evaluated in the HLW&FD EIS, from continued storage of radioactive calcine over a sole source aquifer.

- Failure to meet STP milestones and planning dates, which could result in penalties and corrective actions.

- Failure to accomplish the INL Site accelerated cleanup plan.

- Possible CSSF RCRA storage permit expiration or termination, resulting in potential fines and a closure schedule enforced by consent order.

4. CONSTRAINTS AND ASSUMPTIONS

4.1 Constraints

4.1.1 Operational Limitations

Testing and operations of the calcine retrieval, treatment (if required), packaging, loading, and interim storage facilities will occur after the current ICP contract ends. Only initial planning and turnover of the Calcine Disposition Project are part of the current ICP contract.

Interim storage of treated or untreated packaged calcine pending disposal at the repository is included in the CDP baseline planning. The intent is to reduce the need for interim storage and optimize "just-in-time" shipping if the repository is available for calcine receipt.

Calcine requires special operating methods to shield personnel from radiation, in accordance with as low as reasonably achievable (ALARA) principles. Calcine retrieval, treatment (if required), characterization, packaging, loading, onsite interim storage, and transportation capabilities will require specific remote operations and remote maintenance.

4.1.2 Limitations Associated with the Geographical Location

Section C.2.8.2 of the ICP contract states "The HLW facility design (supporting the RCRA Part B permit), in conjunction with the Sodium-Bearing Waste Packaging Facility, must be capable of retrieval, treatment (if required), packaging, and shipment of all HLW calcine…" Because of this contract requirement, the Integrated Waste Treatment Unit (IWTU) to be constructed by the Sodium-Bearing Waste (SBW) Project will be located east of the Calcined Solids Storage Facility to minimize the length

of the pneumatic transport system for calcine retrieval, treatment (if required), packaging, loading, and interim storage.

4.1.3 Standardization and Standards Requirements

A calcine retrieval, treatment (if required), packaging, loading facility (packaging and loading to be constructed by the Sodium-Bearing Waste Project and modified later for calcine), and interim storage will be constructed within industry standards. Facilities will be constructed to meet local, state, and national codes, such as the International Building Code and National Electrical Code. The facility will also be built to meet the INL Site seismic requirements. HLW facilities, operations, and equipment important to waste acceptance and product quality will meet the *Quality Assurance Requirements and Description* (DOE/RW-0333P). [12]

4.1.4 Environmental, Safety and Health Requirements

During construction, applicable regulations such as Occupational Safety and Health Act (OSHA) and INL Site construction safety practices will be met. No unusual construction methods or practices are anticipated. During operation, the facility will adhere to safety practices such as the Integrated Safety Management System (ISMS) and Voluntary Protection Program (VPP). Facility construction and operation will meet RCRA, Clean Air Act, and other regulatory requirements to ensure protection of human health and environment.

Under the INL Site's ISMS, a project safety and health representative will be assigned to the project team and will support the project manager in implementing the project safety and health program. Safety and health is responsible for coordinating industrial hygiene support within the Project. These ISMS functions and requirements are included in the ICP contract and will be implemented by subcontractors through subcontract requirements.

The project will comply with DOE orders and INL Site requirements. DOE orders defining environmental related requirements include DOE Order 5400.1, *General Environmental Protection Program*, and DOE Order 5400.5, *Radiation Protection of the Public and the Environment*. Responsibilities for implementing the program are defined in a number of ICP environmental program requirements documents and implementing control procedures.

The Radiological Control Program complies with the requirements of 10 CFR 835 and DOE Order 441.1 series. The project will incorporate the radiological control requirements and procedures into the project documents and these will flow down to subcontractors during design and construction.

A Preliminary Documented Safety Analysis (PDSA) report will be completed per DOE STD-3009-94 and DOE Order 420.D, and quality levels will be established. Safety Categories will be established and used as the basis for applying the graded approach criteria required in 10 CFR 830, Subpart A, and in DOE Order 414.1A. Criticality will be addressed in the PDSA. The planning assumption is that criticality is not a problem, as the current safety analysis report (SAR) for the CSSF shows that there are no issues with criticality.

4.1.5 Potential Hazards and their Safety, Security, and Risk Implications

The risk management process for this project will identify, assess, quantify, and prioritize project risks; develop mitigation strategies and plans; and assign responsibilities, monitor, manage, and close out related issues and activities. Project risks include any condition that could cause the project to deviate

from its accepted safety requirements, specified quality levels, baseline cost, scope, or schedule. Significant risks, identified during preconceptual design activities, included potential hazards concerning safety, environment, and security. Risk mitigation design features will be established to minimize the risk to negligible. Safety will continue to be integrated into design early in the design process.

The HLW&FD EIS included accident analysis to identify impacts and risks associated with calcine retrieval and treatment alternatives. Facility accidents with the potential to harm the public included structural failures, fires, and explosions that could result in the release of radioactive and chemical contaminants. Such releases could result in immediate health impacts. However, they are more likely to have a delayed health impact that occurs over time, such as exposure to ionizing radiation that could eventually result in a cancer fatality.

In the case of the Calcine Disposition Project, the overall bounding accident addressed in the HLW&FD EIS involved a hypothetical external event resulting in a release from a vitrification facility, which would bound accidents for direct disposal and the three treatment options currently under consideration. For this hypothetical event, the analysis predicted a dose of 150,000 person-rem to the offsite population within 50 miles of INTEC. This could result in up to 76 latent cancer fatalities due to air impacted for the exposed populations. Potential hazards for the existing Calcine Solids Storage Facility (CSSF) where the calcine is currently stored have been evaluated as documented in safety analysis reports. The safety analysis of the CSSF demonstrates that public health and safety, and the environment are acceptably protected. However, extremely unlikely (beyond credible) postulated seismic events could initiate calcine releases from the storage facilities in sufficient quantities to significantly impact worker health and safety.

Compliance with DOE Orders and Standards provides assurance that risk from implementation of waste processing alternatives is minimized through the incorporation of necessary safety features in the design, construction, and operation of new (and existing) facilities. DOE will continue to control the hazards associated with the calcine retrieval and treatment, if required, consistent with past operations. Worker and public protection is (and will be) provided by the safety-significant structures, systems, and components selection, the Radiation Protection Program, and by other institutional safety programs. The safety-significant structures, systems, and components are (and continue to be) identified by formal hazard and safety assessment documents. All modifications to the safety-significant structures, systems, and components are subject to the Configuration Management Program, and the unreviewed safety question process.

A Preliminary Documented Safety Analysis (PDSA) for the calcine direct disposal alternative is currently being written. It will contain a description of the preconceptual design of the facility with respect to safety significant structures, systems, and components and safety design features, identify research or other data collection necessary to finalize the design, and document the preliminary approaches to startup and operations management. The PDSA, which will be developed during conceptual design, will also show how the nuclear safety design criteria are proposed to be satisfied.

A Physical Security Plan will be completed for the Calcine Disposition Project. The security plan will describe the controls necessary within the facility to appropriately safeguard the activities being performed. The security plan will be a risk management document that provides summary information used to describe safeguards and security programs based on vulnerability, threat, and risk assessments.

4.1.6 Interfaces with Existing and Planned Acquisitions

Section C.2.8.2 of the ICP contract concerning calcine currently states that:

- "The retrieval and treatment (if required) facility design information must be sufficient to support the RCRA Part B treatment permit application and also be compatible and integrated with the SBW packaging and shipping facility to be constructed under C.2.4.3."

- "The HLW facility design (supporting the RCRA Part B permit), in conjunction with the SBW Packaging Facility, must be capable of retrieval, treatment (if required), packaging, and shipment of all HLW calcine within an eight-year shipping period (2015–2022)." (Note that the 2015–2022 shipping period is after the current contract period but is used as design input for throughput. Stipulation of the 2015–2022 shipping period was driven by a projected repository availability date of 2010.) DOE is considering expanding the eight-year shipping period to reduce the size and cost of the operating facilities.

An interface between EM (Cognizant Secretarial Office [CSO] for the Calcine Retrieval and Packaging Facility) and Office of Civilian Radioactive Waste Management (OCRWM) CSO will be required to ensure the treatment (if required), packaging, and loading meets OCRWM requirements for calcine waste form to be disposed of in the repository.

Coordination of shipping schedules and receipt requirements will be needed to minimize interim storage at INTEC. Interim storage of treated or untreated packaged calcine pending disposal at the repository will be included in the CDP baseline planning, with the intent being to reduce the need for interim storage and optimize just-in-time shipping if the repository is available for calcine receipt.

4.1.7 Affordability Limits on Investments

Establishing the Calcine Disposition Project's technical strategy includes evaluating alternatives. The calcine retrieval, treatment (if required), packaging, loading, and interim storage facilities will be designed to minimize operating and life-cycle costs, while providing the required functions. Alternatives analyzed will include treatment options, transportation modes, packaging/loading and interim storage options.

4.1.8 Goals for Limitations on Recurring or Operating Costs

The facility will be designed to complete retrieval, treatment (if required), packaging, loading, and shipping (or interim storage if the repository is not available for HLW). The intent will be to reduce or eliminate the need for interim storage through integration with the OCRWM to incorporate calcine in the repository license and coordinate shipping schedules if the repository is available for calcine receipt. Other goals to limit operating costs are:

- Removal of untreated or treated calcine from RCRA regulation
- Reuse of the SBW Integrated Waste Treatment Unit packaging cell as much as practicable to reduce design, permitting, and construction costs
- Optimization of calcine packaging and loading to minimize the interim storage requirements, minimize use of repository capacity, optimize cask reuse, and reduce shipping costs
- Selection of shipping mode that minimizes operating costs.

4.1.9 Legal and Regulatory Constraints and Requirements

Integration with the OCRWM must occur to coordinate shipping schedules and incorporate untreated or treated calcine in the repository license. Integration would include meeting the *Quality Assurance Requirements and Description* (DOE/RW-0333P) for HLW items and activities important to waste acceptance and product quality, the reuse of casks and the removal of untreated or treated calcine from RCRA requirements. This project is a DOE Environmental Management activity at the INL Site and is subject to laws and regulations that apply to the treatment, storage, and disposal of wastes. Legal, federal, and state requirements for the management of HLW at INTEC include those established under the following:

Atomic Energy Act	The Atomic Energy Act of 1954 (42 USC 2011 et seq.) establishes responsibility for the regulatory control of radioactive materials including radioactive wastes. Pursuant to the Atomic Energy Act, DOE established a series of standards (DOE orders) to protect health and minimize danger to life or property from activities at its facilities.
Nuclear Waste Policy Act	The Nuclear Waste Policy Act of 1982, as amended (42 USC 10101 et seq.), established a national policy for disposal of civilian HLW and spent nuclear fuel in a geologic repository.
DOE Order 435.1	This order applies to the management of all HLW, transuranic waste, and low-level waste, including the radioactive component of mixed waste, for which DOE is responsible, with certain exceptions. This order is to ensure all DOE radioactive waste is managed in a manner that is protective of worker and public health, safety, and the environment.
Resource Conservation and Recovery Act	The HLW calcine includes a combination of "characteristic" (e.g., toxic or corrosive) and "listed" hazardous wastes that are regulated under RCRA. New facilities to implement DOE's waste disposition decisions for this project would be regulated under RCRA.
Idaho Settlement Agreement	In October 1995, the State of Idaho, Department of the Navy, and DOE settled the cases of Public Service Company of Colorado v. Batt, involving the management of spent nuclear fuel at INL Site. The Settlement Agreement/Consent Order (USDC 1995) requires DOE to: • Complete a NEPA Environmental Impact Statement (EIS) for disposition of calcine and issue a Record of Decision (ROD) by December 31, 2009. • Submit to the State of Idaho a RCRA Part B permit application for the calcine disposition facilities by December 1, 2012. • Complete disposition (treatment) of all calcined waste by December 31, 2035. The Settlement Agreement/Consent Order provides that DOE may request that the Agreement be modified to conform to the selected actions in the event that these actions conflict with the Agreement. It is assumed that directly packaging and disposing of calcine "as-is" may be considered the equivalent of treatment.

Site Treatment Plan (under the Federal Facility Compliance Act)	Under the Federal Facilities Compliance Act of 1992, DOE entered into an agreement with the State of Idaho to specify how it would attain compliance with applicable treatment requirements for mixed wastes at INL Site. The Site Treatment Plan sets forth the terms and conditions that DOE must comply with to satisfy the land disposal restrictions applicable to the hazardous components of the mixed wastes at INTEC. It contains an enforceable schedule with the milestones for CD-0 and CD-1. The milestones can be deferred before they are due for up to one year without undergoing public comment.
Clean Air Act	Design, construction and operations will be regulated under the Clean Air Act.
Clean Water Act	If applicable, Storm Water requirements will be met.

4.1.10 Stakeholder Considerations

Stakeholder activities conducted in support of the *Idaho High-Level Waste & Facilities Disposition Final Environmental Impact Statement* are identified in the Chapter 6.0, *Statutes, Regulations, Consultations, and Other Requirements*, of the Final EIS (FEIS). The FEIS (DOE/EIS-0287) was distributed during September 2002. Both the hazardous waste and air permitting process with the State of Idaho involve public meetings prior to issuance of a permit. The stakeholders have been identified through the EIS process and in the ICP contract, Section H.25 - *Stakeholder Interaction*. The project will continue to support the existing stakeholder programs. Stakeholder relations will be included as part of the ICP stakeholder program.

4.1.11 Limitations associated with Program Structure, Competition and Contracting, Streamlining, and Use of Development Prototypes or Demonstrations

Internal and external resources and services may be required to meet the accelerated cleanup deadlines and acquisition approach.

The acquisition approach is to be led by the Federal Project Director. The project director will assemble the team needed for the planning process. The team will be knowledgeable about the regulatory, technical, operation, shipping, and disposal requirements and have access to information. DOE acquired services based on an acquisition strategy for preconceptual design and other support activities for the development of CD-0 through CD-1 by the award of the ICP contract. This approved ICP contract scope will be supplemented by future contract modifications and/or awards consistent with the acquisition strategy.

Subcontracting options will be evaluated to establish the most cost-effective approach for obtaining design, procurement, construction, and startup services that comply with the project schedule. The acquisition strategy will address contracting alternatives.

4.2 Assumptions

High-Level Calcine Disposition Project assumptions include the following:

- Funding will be available to support the project throughout its entire schedule to meet the accelerated calcine disposition completion milestone.

- The *Idaho High-Level Waste and Facilities Disposition Final Environmental Impact Statement* ROD for calcine treatment and disposition will be a dual-path ROD that includes both a treatment and a non-treatment ("as is") disposal option.

- The Settlement Agreement milestone for selecting a calcine treatment will be satisfied by issuing a dual-path ROD for the Idaho High-Level Waste and Facilities Disposition EIS by December 31, 2009, and an amended ROD selecting a single path by 2012.

- A supplement analysis will be used to develop and support the dual-path ROD. A Supplemental EIS with input from cooperating agencies (Idaho DEQ), public hearings, and comment resolution will not be required in the absence of significant new circumstances or information.

- Site Treatment Plan milestones and planning dates will be consistent with the dual-path described in the ROD.

- Central to both paths identified in the dual path ROD will be the retrieval, packaging, and loading, of treated or untreated HLW calcine. This allows for preliminary design of the retrieval and packaging systems without presupposing the ROD.

- Central to both paths identified in the dual path ROD will be interim storage for packaged calcine until it can be shipped to the repository.

- Under the non-treatment pathway, calcine will be retrieved "as-is," directly packaged in standard canisters, and loaded into casks without treatment for disposal at the repository.

- Under the non-treatment pathway, the SBW product loading and packaging module design will include minimal accommodations to allow retrofit for future calcine packaging and loading.

- Any treatment method selected in the dual path ROD will treat characteristic constituents and allow EPA Region 10 to delist the treated calcine.

- The calcine waste form must be removed from RCRA regulation by petitioning EPA (or regulatory equivalent) to meet the repository waste acceptance criteria, which is dependent upon many external regulatory and/or legislative approvals.

- The RCRA Part B Permit application required by December 1, 2012, in the Settlement Agreement will be based on completion of preliminary design. Final design will be incorporated into the permit to support the start of construction.

- Shipping and disposal costs for calcine are borne by the Office of Civilian Radioactive Waste Management.

- The calcine waste form will be sent to the repository or transferred to interim storage to allow completion of deactivation, decontamination, and decommissioning of the retrieval, treatment (if required), packaging, loading, and interim storage facilities and Calcined Solids Storage Facility (CSSF) by December 31, 2035.

- Co-shipping of SNF and calcine is not currently planned.

- Deactivation, closure and demolition of Calcine Disposition Project facilities will include clean closure of new facilities and performance-based closure for existing facilities in accordance with the December 2005 Idaho HLW and Facilities Disposition ROD.

5. APPLICABLE CONDITIONS AND INTERFACES

5.1 Compatibility Requirements with Existing or Future Systems

EM-WAPS Rev. 03, 1998 - *The Waste Acceptance Product Specifications for Vitrified High-Level Waste Forms*[13] addressed the current path for HLW, which is vitrification. Once the disposal option for HLW is determined, final demonstration of the selected calcine waste form's impact on performance will be documented. The *Waste Acceptance System Requirements Document* (WASRD) allows alternate waste forms if they do not significantly impact the repository performance. Preliminary groundwater analysis of untreated calcine disposal using the TSPA model provides sufficient technical confirmation that calcine, treated or untreated, can be safely disposed at the repository. Deterministic modeling with the TSPA will be submitted after the treatment (if required) is selected, selected waste form testing is completed, and confirmatory TSPA modeling is performed. Compliance to the Waste Acceptance Criteria (WAC) and waste packaging will be documented.

Direct disposal or treatment of calcine requires approval of a petition (or equivalent regulatory initiative) from EPA to remove calcine from RCRA regulation. The petition will be submitted after the treatment is selected, selected waste form testing is completed, and confirmatory TSPA modeling is performed. EPA review and approval of the petition will take from three to five years. The ICP contractor developed a draft regulatory path forward (petition), which included use of the Yucca Mountain Project final EIS Total Site Performance Assessment computer model to analyze direct disposed calcine. Based on the modeling, the potential RCRA constituents were at least two orders of magnitude below regulatory concentrations at the "point of compliance," indicating that direct disposed calcine would meet the requirement of being protective of human health and environment and provide sufficient technical confirmation that calcine, treated or untreated, can be safely disposed of at the repository. Deterministic modeling with the TSPA, after the radiological standard is incorporated into the model, will be performed on the selected treatment.

The *Idaho High Level Waste and Facilities Disposition Final Environmental Impact Statement*, issued in September 2002, analyzed alternatives for HLW calcine disposition, including the option of leaving the waste in place, and established the impacts of the alternatives to the environment.

The *INTEC Final Waste Forms Requirements Study* (INEEL/INT-1999-01384, December 1999, Banaee, J., et al.)[14] was written to assist scientists and engineers with process (calcine, SBW, and newly generated liquid waste) flowsheet development, equipment design, and final waste form qualification. Part I evaluated the existing INTEC waste, evaluates the current regulatory requirements, and identifies the WAC of potential disposal sites. Part II evaluated the processes in each waste treatment option, estimated the component concentration in each waste, compared predicted final waste form constituents with the WAC, and identified technology development issues. This study identified waste disposal facilities, their waste acceptance criteria, regulatory requirements and focused on the concentration of the constituents in the final waste forms produced by process options identified in the High-Level Waste and Facility Disposition Environmental Impact Statement.

The "Preliminary Sensitivity Studies for Total System Performance Assessment in Support of INEEL Calcine Direct Disposal" (EDF-4158, September 2004) evaluated performance of the HLW calcine in the repository environment using computer models. The study concluded that adding HLW

calcine had a small effect on the total repository performance when compared to all the waste expected to be disposed in the repository. The study also concluded that the performance of the repository system as a whole is not sensitive to changes in the calcine radionuclide inventory for values up to 25 times the base calcine inventory used. Additional studies will be completed and peer reviewed as requirements evolve and the calcine waste form is defined.

The "Test Plans for the Calcine Canister Project" (EDF-4557, February 2004)[15] contains the test plans for scientific investigations to be carried out to support calcine canister development efforts. This canister is to be loaded with untreated calcine for onsite interim storage or transported to the repository for direct disposal. EDF-4557 contains the test plans for the following: (1) drop testing of calcine behavior test specimens, and (2) high-strain material impact testing for calcine canisters. Succeeding revisions will add new test plans. A similar test will be needed for a treated calcine waste form.

5.2 Integration with Similar Department Needs

The INL Site is the only DOE site with HLW calcine. Similar regulatory initiatives such as Hanford's delisting may be beneficial depending on the outcome of the dual path ROD for calcine disposition. Similarly, Idaho's regulatory petition to EPA may benefit development of a disposition path for cesium and strontium capsules currently stored at Hanford. Calcine Disposition Project efforts will be closely integrated with the repository development to coordinate design interfaces and waste shipping schedules, optimize disposal, and ensure the waste product conforms with the WAC. Calcine Disposition Project integration with other on-site projects (especially the SBW Project regarding potential reuse of IWTU capabilities), DOE organizations, national laboratories and outside stakeholders is addressed in Subsections 5.3 and 5.4.

5.3 On-Site Project Interfaces

The Calcine Disposition Project is one of several interrelated subprojects in the ICP. The related subprojects include SBW Treatment, Tank Farm Closure, and Tank Farm CERCLA soils remediation. These projects were integrated under the *Environmental Management Performance Management Plan for Accelerating Cleanup of the Idaho National Engineering and Environmental Laboratory* and the ICP contract. Interfaces with the SBW Project packaging facility and with the INTEC infrastructure (electrical power, steam, water, etc.) are expected regardless of the option selected.

The Calcine Disposition Project will also establish interfaces to obtain, at a minimum, the following INL Site services:

- Maintenance Coordination
- Financial Operations
- Supply Chain Management
- Radiological Controls
- Laboratory Analysis Support
- Waste Generation Services
- Quality Assurance.

5.4 Other Interfaces

5.4.1 DOE Organizations

The HLW calcine from this facility will be disposed at the national repository according to the requirements of the Nuclear Waste Policy Act. The WAC for waste and its package (canister) at the repository will not be finalized until the repository license is issued. Therefore, the project will interface with OCRWM to ensure the waste product will conform to the evolving repository WAC as required. An interface agreement will be developed between DOE-ID, OCRWM, and DOE National Nuclear Security Administration, Nevada Operations Office (NNSA/NV), that will formalize and specify communications between these organizations so that DOE-ID and the ICP will be kept informed of changes in the developing repository WAC to ensure impacts can be handled in an expeditious manner.

In addition to meeting the repository WAC, the project will need to coordinate design interfaces and waste shipping schedules with the repository. Coordination between DOE-ID and the repository is critical to reduce or eliminate the need for INL onsite interim storage facilities for packaged "road-ready" calcine. Existing storage facilities at INTEC may be suitable for this interim storage requirement, but still would be costly to modify and permit with the State of Idaho. As in the case of the WAC issues, the interface agreement will provide for frequent communication of any changes in shipping needs and associated capabilities between DOE-ID and NNSA/NV. The number of waste canisters and volumes associated with the untreated and treated calcine has been analyzed in shipping scenarios. EM continues to support integration of complex-wide shipping schedules.

AEA Technology (AEAT) Engineering Services Inc. is currently working with DOE-EM to develop equipment which will be utilized for calcine retrieval. This equipment technology activity will be transferred to the ICP contractor and become part of their design work during FY 2007.

5.4.2 National Laboratories

The INL Site has benchmarked and shared information on technologies with other DOE sites and Laboratories. ICP personnel participated in conceptual studies for dry particulate solids retrieval and transport that has been successfully used at Fernald. Remote mechanical technology and methods have been developed, demonstrated, and used at the INL Site, as well as other sites such as Savannah River Site, the West Valley Demonstration Project, and Hanford. Interface between the ICP contractor and the INL National Spent Fuel Program with regard to packaging, remote welding technologies, and repository waste acceptance will continue. The exchange of technology information will continue through the life of this project.

5.4.3 Outside Stakeholders

The NEPA process for this project was started early in order to determine environmental impacts of the disposition of calcine. This provided opportunity for outside stakeholder involvement. Continued involvement is expected. The project plans to work through the ICP public affairs organization to interface with outside stakeholders, including the State of Idaho and the Idaho Site Citizen's Advisory Board.

The *EM Performance Management Plan for Accelerating Cleanup of the Idaho National Engineering and Environmental Laboratory* includes an agreement concerning the intent of the State of Idaho, the U.S. EPA, and DOE to work together to implement the plan's objectives of accelerated risk reduction and cleanup strategy. In addition, interfaces will continue with the State of Idaho and EPA Region 10 in regard to RCRA, air, water, and other environmental permitting issues and processes.

6. RESOURCE REQUIREMENTS AND SCHEDULE

6.1 Project Planning and Schedule

The requirement of the Settlement Agreement is to have calcine ready for shipment from Idaho by December 2035. Engineering feasibility studies at various levels of detail have been performed for calcine retrieval, packaging, loading, and shipping.

Current cost estimates (see Section 7.4) are based on costs in the *Independent Calcine Disposition Project Review and Cost Estimate*, performed under Contract DE-AT07-06ID60550 by C/P/E Environmental Services, LLC. This study assessed current plans for treatment, packaging, loading, and shipment of calcine for disposal, including technical and other activities required for each option to ensure that "cradle-to-grave" information is available for each proposed alternative and that each option has a current well-constrained cost estimate. The study was designed to provide current information and an analysis of the costs and cost basis for direct disposal of calcine in canisters, and for comparison against the cost and technical basis for direct vitrification. Because the current ICP contractor is developing steam reforming at the Integrated Waste Treatment Unit, that process was also reviewed and a current independent cost estimate for that option developed. Finally, a variant of hot isostatic pressing (HIP) was identified as a process that can produce an acceptable monolithic waste form and it was also evaluated. Based on process descriptions, facility descriptions, and a work breakdown structure developed for each option by the technical team, a cost estimate was developed. Uncertainty estimates were developed for both cost and schedule estimates. The study assumes operations occur from 2015 to 2022, as specified in the ICP contract, and design and construction activities are constrained to support that operating period. It should be noted that modifications to the ICP contract may be needed to meet project requirements.

Because the repository license application has been delayed, it is unlikely the repository will be able to receive calcine prior to 2017. However, regulatory commitments in the Settlement Agreement and Site Treatment Plan have not changed. Therefore, the project will proceed to meet the regulatory milestones contained in Table 4. If milestones are renegotiated, the project will adjust.

Preliminary Design will provide details for the RCRA Part B permit application submittal to the State of Idaho by December 1, 2012 (Settlement Agreement milestone). In parallel with this, legal and regulatory work will be conducted with the State of Idaho, U.S. EPA, and parties concerned with the repository to gain acceptance for disposal of the untreated or treated HLW calcine. Issuance of the NEPA EIS (dual-path) ROD is required by December 31, 2009 (Settlement Agreement milestone). This will provide decision-making criteria for direct disposal and a treatment option that will be applied to select a single disposition path documented in an amended ROD to be issued prior to submittal of the RCRA Part B Permit application. The project will then move forward into final design, permitting and construction. State of Idaho regulators have indicated that at least two years will be required to review the permit applications. Further, it is anticipated that State of Idaho regulators will not allow construction efforts to commence until environmental permits are in place. Construction will be completed in coordination with the repository's integrated acceptance schedule, or the calcine will be transferred to interim storage in "road-ready" form by 2035.

Table 4. List of current calcine disposition regulatory driven milestones.

Milestone Drivers	Milestone Description	Milestone Date
Settlement Agreement (SA) Section E.6	Issue a Record of Decision (ROD) identifying calcine retrieval and treatment technologies	12/31/2009
	Issue a ROD that includes the schedule for ROD implementation.	12/31/2009
	Submit to the State of Idaho an application for a RCRA (or statutory equivalent) Part B permit	12/1/2012
	The ROD plan and schedule shall provide for the completion of the treatment of all calcined waste located at the INL Site by a target date of 12/31/2035.	12/31/2035
Site Treatment Plan (STP)	Define Calcine Disposition Project (CDP) – Critical Decision – 0 (CD-0)	3/31/07
	Identify CDP Funding Requirements – CD-1	3/31/2008
	STP Milestone P-2 - Identify and Develop Technology – According to the Settlement Agreement Section E.6, the Record of Decision issued by December 31, 2009, will identify calcine retrieval and treatment technologies. DOE will submit a separate P-2 milestone letter, after ROD signature.	3/31/2010
	Submit CDP Treatability Study Notification	Milestones Not Yet Planned
	Submit CDP R&D Permit Applications	Milestones Not Yet Planned
	STP Milestone P-5 - Schedule for Table 5-1 (Table 2-1 Milestones/Planning dates) – According to the Settlement Agreement Section E.6, the December 31, 2009, ROD will include the schedule for ROD implementation. DOE will submit a separate P-5 milestone letter after any issues resulting from completion of the P-2 milestone are resolved.	6/30/2010
	Submit RCRA Part B application (or regulatory equivalent) for calcine retrieval, treatment (if necessary), packaging, and loading.	12/1/2012

6.2 Critical Decision Dates

Table 5 provides the planned Critical Decision (CD) dates for the Calcine Disposition Project. The critical path is driven by Settlement Agreement and Site Treatment Plan milestones, with vitrification as the bounding treatment based on cost and schedule. CD-0 approval is needed in the near term for critical path completion of the Table 4 milestone drivers. Schedule estimates will continue to be developed and refined as required by DOE Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets*, prior to subsequent critical decisions. Future schedule and project performance will be dependent upon and directly impacted by numerous external entities and actions (State of Idaho, EPA, the repository and its NRC license application and license approval, transportation, etc.) If the critical decision dates listed in Table 5 are not met, the project will require significant replanning. Although calcine may be safely stored in its current configuration for decades, it is not currently permitted under RCRA for long term storage. Compliance with the Idaho Settlement Agreement and RCRA regulatory agreements drives the development of a NEPA ROD. Final disposition of calcine is dependent on the availability of a repository and the selected disposal form is dependent on the acceptance criteria for the repository. Final issuance of the RCRA Part B permit required by the Settlement Agreement and consent by the State of Idaho for DOE to start physical on-site construction is expected to occur in conjunction with CD-3.

Table 5. Critical decision dates.

Decision	Date Needed
CD-0, Approve Mission Need – project initiation and start of Conceptual Design	March 2007 (STP Milestone)
CD-1, Approve Preliminary Baseline Range – start of Preliminary Design	March 2008 (STP Milestone)
CD-2, Approve Performance Baseline – start of Final Design	December 2011 (Critical Path Schedule)
CD-3, Approve Start of Construction	June 2015 (Critical Path Schedule)
CD-4, Approve Start of Operations	January 2021 (Critical Path Schedule)
The critical decision milestones are driven by vitrification as the worst case treatment.	

6.3 Project Funding Profile and Cost

Cost estimates were based on costs in the *Independent Calcine Disposition Project Review and Cost Estimate*, performed under Contract DE-AT07-06ID60550 by C/P/E Environmental Services, LLC. These estimates are life-cycle cost estimates that reflect "cradle to grave" costs anticipated for removing the calcine product from the existing bin sets to final disposition in the proposed repository, closing the bin sets, and decontamination and decommissioning (D&D) of the treatment facilities. As such, the life-cycle costs are not segregated into budget requirements for DOE-ID and for the repository; rather they fulfill the life-cycle management model requirements from DOE M 413.3-1, which states "at least one additional life-cycle cost estimate should be prepared by an organization independent of the project office and the acquisition chain of command." The life-cycle costs for each of the four alternatives include anticipated disposal cost charges of $620,000 per waste canister at the repository, independent of the waste treatment process used or waste form residing in the canister. A significant cost driver for the life-cycle cost estimates is the total number of canisters to be shipped, favoring a treatment that involves waste volume reduction when total life-cycle costs are considered. This is apparent when considering the life-cycle costs (with contingency) for the four options. The total life-cycle cost difference between vitrification ($23.9 billion) as the worst case treatment option and direct disposal of calcine ($6.8 billion) as the least cost option is $17 billion. The life-cycle cost of the Calcine Disposition Project itself (without factoring in shipping and disposal costs) ranges from $2.3 billion (direct disposal) to $16.3 billion (direct vitrification).

The life-cycle costs represent an 8-year (2015–2022) operations window stipulated in the ICP contract. This window was based on repository availability in 2010. Relaxation of the operations timeframe to a 12-year operating window could significantly reduce project costs without adverse impact on meeting the 2035 "road ready" Settlement Agreement date. DOE is currently considering expanding the 8-year shipping period.

Disposal charges and other costs are subject to change as this project matures and the repository progresses towards operation. The time periods listed in Table 4 are for planning purposes only and provide a framework for the estimated cost of completing each project phase to achieve the necessary critical decisions. The 2009 NEPA ROD may change all dates beyond 2009. Actions outside the control of the project will also impact the time, and hence, the cost of each project phase. Cost estimates will continue to be developed and refined as required by DOE Order 413.3A prior to subsequent critical decisions. The actual cost baseline for the project will be refined through project initiation and finally established with CD-2 approval as specified in DOE Order 413.3A. The dates for the critical decisions are

based on the Critical Path schedule, which assumes renegotiation of the existing ICP contract. Vitrification is considered the bounding treatment in the Critical Path schedule. Shorter, concurrent activity durations for direct disposal are shown on the schedule in blue. Other disposition options are expected to generally fall within the cost and schedule range defined by these two options.

6.4 Measures to Determine Project Success

Performance metrics that are driven by enforceable milestones, as well as schedule and cost, will be established for scope and major deliverables. Figure 2 is a critical path schedule, which is driven by EPA and treatment activities. It graphically depicts work scope and major external and internal milestones. The schedule lists the critical path, critical decision dates, and milestones for the Settlement Agreement, regulatory, treatment, direct disposal, and project design and integration activities.

6.4.1 Measure of Schedule Success

For the project definition and retrieval design portion of this project, schedule success will be measured according to the ICP contract, Section H.1, *Project Control Systems and Reporting Requirements*, which requires the contractor to establish, maintain and use a project control system that accurately reflects the project status relative to cost and schedule performance, and tracks changes to the baseline in accordance with DOE O 413.3A, *Program and Project Management for the Acquisition of Capital Assets*. After the ICP contract is completed, both quantitative and qualitative measures will continue to be used to establish schedule success. The project will measure schedule performance using an earned value system to measure quantifiable work accomplishments with respect to completed deliverables. Engineering and procurement deliverables (i.e., drawings, specifications, material requisitions) are planned to be tracked using progress and performance measurement tools. Contract earned-value will be determined on a regular basis. Variances from planned schedule performance will be reviewed and reconciled by project management with corrective action.

6.4.2 Measuring Cost Success

For the project definition and retrieval design portion of this project, cost success will be measured according to the ICP contract, Section H.1, *Project Control Systems and Reporting Requirements*, which requires the contractor to establish, maintain and use a project control system that accurately reflects the project status relative to cost and schedule performance, and tracks changes to the baseline in accordance with DOE O 413.3A, *Program and Project Management for the Acquisition of Capital Assets*, which requires the contractor to establish, maintain and use a project control system that accurately reflects the project status relative to cost and schedule performance, and tracks changes to the baseline in accordance with DOE O 413.3A, *Program and Project Management for the Acquisition of Capital Assets*. Cost performance will be measured using a Work Breakdown Structure (WBS) to subdivide the total project into manageable units of work, which are then subdivided into successive lower levels of detail. Costs will be collected in alignment with the WBS, and the required reports will be generated. Earned Value Management is planned to be used to report variances from the baseline planned progress. Variances from planned cost performance will be reviewed and reconciled by project management, with corrective actions identified and implemented.

Critical Path – Regulatory and Treatment Driven

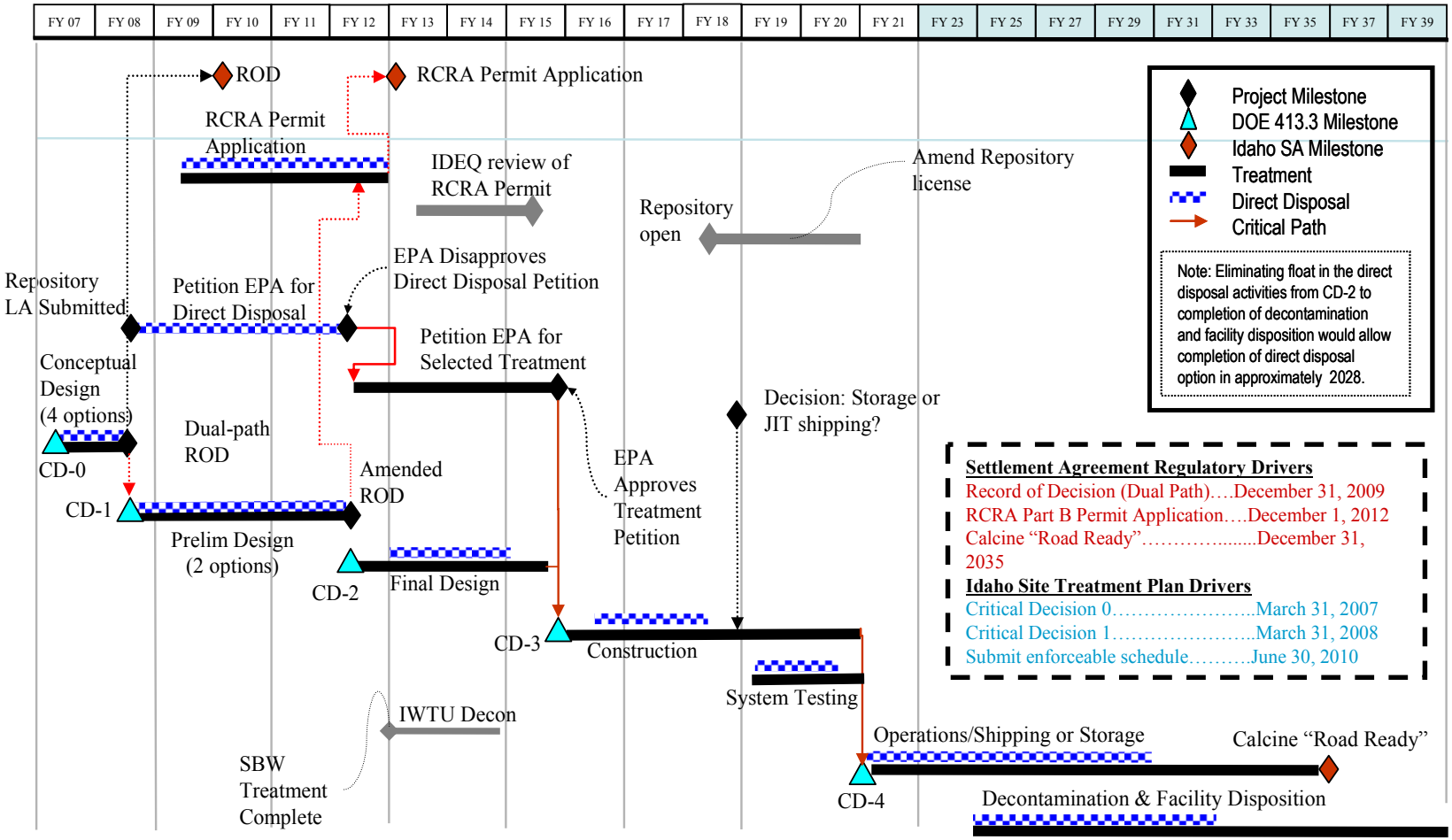

Figure 2. Critical path schedule.

6.4.3 Measuring Successful Project Completion

Because this project is for disposition of a waste form, it includes a construction phase, an operations phase, and a facility closure phase. The construction phase will be considered complete when facilities to retrieve and directly package or treat (if required) the calcine waste for disposal at the repository or an interim storage facility are constructed, tested, and turned over to operations staff. During the operations phase, progress will be measured by the canister count and number of shipments to the repository or interim storage facility. Overall operations success will be achieved when the HLW calcine is shipped from Idaho and disposed of at the repository. An approved RCRA closure plan for the emptied bin sets, packaging and loading systems, onsite interim storage, and treatment processes (if required) will be implemented, which will mark the successful completion of the closure phase of the project. Overall project success will be achieved when all three phases have been successfully completed.

7. DEVELOPMENT PLAN

7.1 Previous Planning Activities

Preconceptual design activities, including feasibility studies, in support of the *Idaho High-Level Waste and Facilities Disposition Final Environmental Impact Statement* were completed for the Calcine Disposition Project. The feasibility studies and the EIS were reviewed internally by contractor personnel and externally by a variety of stakeholders, including the State of Idaho, which participated as a cooperating agency in preparing the EIS. The documentation developed during preconceptual design will support the start of conceptual design.

7.2 Schedule for Reaching the Major Milestones and Critical Decision Points

Figure 2 is a critical path schedule, which is driven by EPA and treatment activities. It graphically depicts work scope and major external and internal milestones. The schedule lists the critical path, critical decision dates, and milestones for the Settlement Agreement, regulatory, treatment, direct disposal, and project design and integration activities.

Scope, cost, and schedule information will be developed sufficiently to assess implementation impacts for project activities, and evaluation criteria will be developed based on potential impacts/risk to completion of the Calcine Disposition Project. Scope, cost, and schedule information will include:

- Safety authorization basis
- Regulatory and legal agreements
- Regulatory permits
- Facilities, equipment, and infrastructure
- Operations
- Decontamination and facility disposition.

7.3 Approach to Concept Development

Calcine Disposition Project activities planned after approval of CD-0 to obtain CD-1 include the preparation of a Conceptual Design Report that clearly and concisely defines the project. A Design Review will be conducted to determine if drawing, analyses, or specifications are correct and perform its intended function and meet requirements. Feasibility studies on the three treatment options plus direct disposal of calcine concerning waste loading, retrieval throughput, IWTU utilization, cost comparisons, physical testing, value engineering sessions, and stakeholder discussions will be completed. The EPA petition for direct disposal will be initiated. The supplement analysis concerning ES&H impacts will be completed and a dual path ROD will be issued. Cost ranges will be refined and schedules will be aligned with the repository schedule.

7.4 Possible Alternatives

The following two alternatives were developed to address the Calcine Disposition Project needs:

- Calcine direct disposal – This alternative would involve retrieval of calcine from the bin sets and preparation, packaging, loading for onsite interim storage or just-in-time shipment to the repository.

- Calcine treatment and disposal – This alternative would build on previous evaluations of various calcine treatments such as vitrification, grout, hydroceramic cement, iron-phosphate ceramic, grout cement, synroc/ANSTO ceramic, cold crucible induction melter, steam reforming, etc. Treatment would entail retrieval of calcine from the bin sets, treating it to a suitable form, packaging, loading, and onsite interim storage or just-in-time shipment to the repository. To date, three options in addition to direct disposal have been selected for further evaluation – direct vitrification, hot isostatic pressing (HIP - synroc/Ansto ceramic), and steam reforming. The dual path ROD will select direct disposal and one preferred treatment option. Before the dual path ROD is issued, for the purposes of planning, any treatment option's cost and schedule will be assumed to be enveloped by vitrification. When the project cost and schedules are expressed as a range, the low and high ends of the range will be set by direct disposal and vitrification. Cost and schedule ranges for individual options are set at the 85th percent confidence interval as determined in *Independent Calcine Disposition Project Review and Cost Estimate*, performed under Contract DE-AT07-06ID60550 by C/P/E Environmental Services, LLC.

Figure 3 graphically presents the relative cost and schedule ranges for direct disposal and the three treatment options, bounded by the 85th percent confidence interval for each option.

An amended ROD choosing one disposition path (either untreated calcine or a specific calcine treatment) and addressing closure of the bin sets and their associated facilities will be issued concurrently with CD-2.

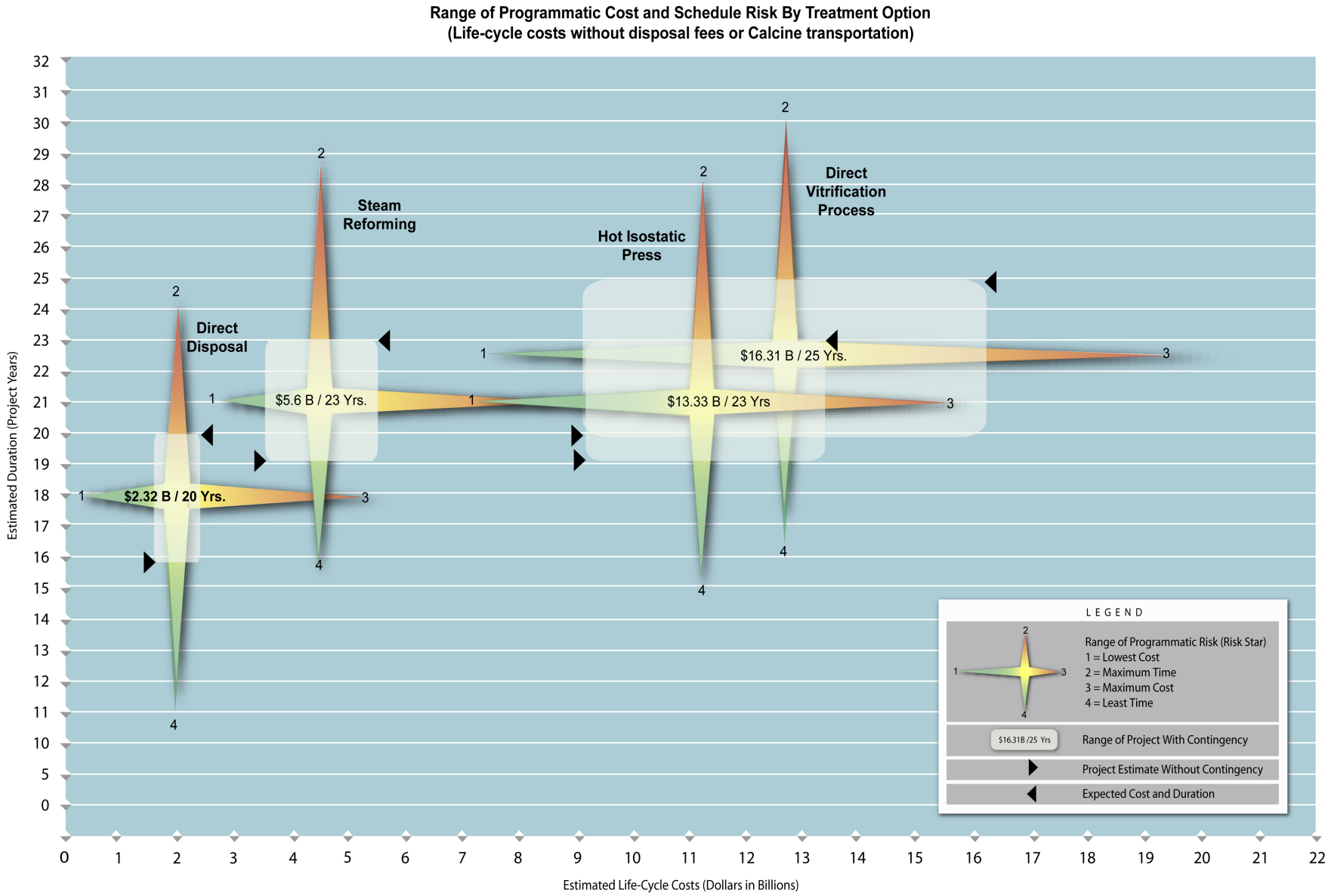

Figure 3. Range of programmatic cost and schedule by treatment option (CDP only).

8. SUMMARY

The Calcine Disposition Project will construct necessary facilities to retrieve, directly package or treat, load for onsite interim storage or ship approximately 4,400 cubic meters (155,000 cubic feet, or 1.15 million gallons) of HLW calcine currently stored at the INL Site. Disposition ("treatment") of the calcine is required by the Idaho Settlement Agreement and accelerated by the PMP. The Idaho Settlement Agreement requires that DOE put calcine in a form suitable for shipment from Idaho by a target date of 2035. Interim milestones require a Record of Decision to identify the methods that will be used to dispose of calcine including treatment (if necessary) by December 31, 2009, and submission of a Resource Conservation and Recovery Act (RCRA) Part B permit application for the selected treatment by December 1, 2012. The consequence of missing final or interim calcine disposition Settlement Agreement milestones is the suspension of DOE SNF shipments into Idaho, which could impact the anticipated spent nuclear fuel swaps planned between the Savannah River Site and Idaho National Laboratory.

Direct disposal or treatment of calcine requires approval of a petition (or equivalent regulatory initiative such as congressional action) from EPA to remove calcine from RCRA regulation, or modification of the repository waste acceptance criteria. The petition will be submitted after the treatment is selected, selected waste form testing is completed, and confirmatory TSPA modeling is performed. EPA review and approval of the petition will take from three to five years. The ICP contractor developed a draft regulatory path forward (petition), which included use of the Yucca Mountain Project final EIS TSPA computer model to analyze direct disposed calcine. Based on the modeling, the potential RCRA constituents were at least two orders of magnitude below regulatory concentrations at the "point of compliance," indicating that direct disposed calcine would meet the requirement of being protective of human health and environment and provide sufficient technical confirmation that calcine, treated or untreated, can be safely disposed of at the repository. Deterministic modeling with the TSPA, after the radiological standard is incorporated into the model, will be performed on the selected treatment waste form to confirm earlier results. This TSPA modeling will include evaluating the waste form physical and chemical data, modeling the data to document behavior of the waste form in the repository, documenting that the results are below regulatory concentrations requirements, and documenting the analysis activities and results.

Approval of the Calcine Disposition Project Critical Decision-0 is needed by March 31, 2007, to begin the work scope to retrieve, treat (if required), package, and load the calcine for interim storage or disposal at the repository and enable DOE to:

- Meet legal commitments made by DOE in the Settlement Agreement and Site Treatment Plan
- Meet EM objectives for accelerated site cleanup outlined in the *DOE Environmental Management Performance Management Plan for the Accelerated Cleanup of the Idaho National Engineering and Environmental Laboratory*
- Avoid possible fines under RCRA
- Implement the 2005 Idaho HLW and Facilities Disposition EIS ROD
- Avoid impacting anticipated spent nuclear fuel swaps between the SRS and INL necessary to complete the Enriched Uranium Disposition Project as currently planned.
- Reduce environmental risks of continued storage of radioactive particulate solid waste over the Snake River Plain Aquifer, as evaluated in the *Idaho High-Level Waste and Facilities Disposition Final Environmental Impact Statement*.

9. REFERENCES

1. *Settlement Agreement between the State of Idaho, the Department of Energy, and the Department of the Navy, to resolve all issues in the actions Public Service Co. of Colorado v. Batt, No. CV-91-0035-S-EJL (D. Id.) and United States v. Batt, No. CV-91-0065-S-EJL (D. Id.)*, dated October 16, 1995.

2. *Independent Calcine Disposition Project Review and Cost Estimate*, performed under Contract DE-AT07-06ID60550 by C/P/E Environmental Services, LLC, May 2006.

3. *Idaho High-Level Waste and Facilities Disposition Final Environmental Impact Statement*, DOE/EIS-0287, September 2002.

4. "*Record of Decision for the High-Level Waste and Facilities Disposition Final Environmental Impact Statement*," DOE/EIS-0287, U.S. Department of Energy, December 2005.

5. DOE Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets*, July 28, 2006.

6. High-Level Waste Program, FY 2005-2070 Life-Cycle Baseline, Idaho, January 2002.

7. *Environmental Management Performance Management Plan for Accelerating Cleanup of the Idaho National Engineering and Environmental Laboratory*, DOE/ID-11006, dated July 2002.

8. EDF-4158, "Preliminary Sensitivity Studies for Total System Performance Assessment in Support of INEEL Calcine Direct Disposition," September 2004.

9. Letter of Intent between DOE, Environmental Protection Agency, and Idaho Department of Environmental Quality, formalized on July 11, 2002.

10. DOE-ID, *Strategic Plan – 2005 and Beyond*.

11. *Idaho Cleanup Project Contract*, DE-AC07-05ID14516, dated March 23, 2005.

12. DOE, 2006, *Quality Assurance Requirements and Description*, DOE/RW-0333P, Rev. 17, U.S. Department of Energy, May 2006.

13. *Waste Acceptance Product Specifications for Vitrified High-Level Waste Forms,* (EM-WAPS Rev. 03, 1998).

14. *INTEC Final Waste Forms Requirements Study,* (INEEL/INT-1999-01384, December 1999, Banaee, J., et al.).

15. EDF-4557, "Test Plans for the Calcine Canister Project," February 2004.